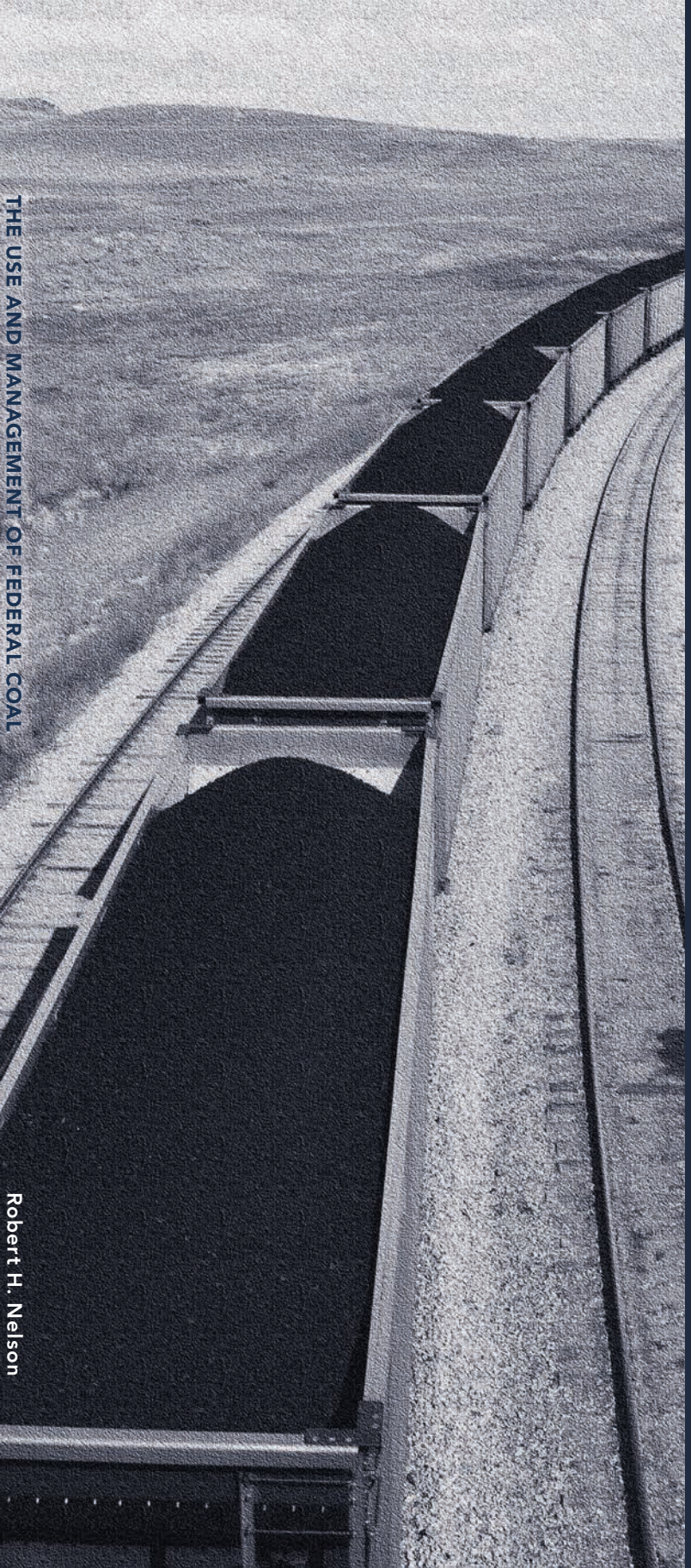

THE USE AND MANAGEMENT OF FEDERAL COAL

Robert H. Nelson

PERC

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# FEDERAL COAL

By Robert H. Nelson

# ABOUT PERC

PERC—the Property and Environment Research Center—is a nonprofit research institute dedicated to improving environmental quality through markets and property rights. Located in Bozeman, Montana, PERC pioneered the approach known as free market environmentalism. PERC's staff and associated scholars conduct original research that applies market principles to resolving environmental problems.

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# ABOUT THE AUTHOR

**Robert H. Nelson** was a member of the Economics Staff of the Office of Policy Analysis in the Office of the Secretary of the Interior from 1975 to 1993. While at the Interior Department, he participated in the review and design of the federal coal program from 1978 to 1984. In 1983 and 1984, he was also the senior economist of the Congressionally established Commission on Fair Market Policy for Federal Coal Leasing (the Linowes Commission). He is the author of *The Making of Federal Coal Policy* (Duke University Press, 1983) and *Public Lands and Private Rights: The Failure of Scientific Management* (Rowman & Littlefield, 1995). Since 1993, he has been a professor in the School of Public Policy of the University of Maryland.

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# FOREWORD

While the U.S. economic system is based on the principle of private ownership of property, the vast system of federally owned lands and natural resources in the American West is a glaring exception. Coal owned by the federal government—which makes up about one-third of the coal in the United States—is among the most important of these exceptions. Owing to such large amounts of public ownership, especially in western states, standard ways of economic thinking often do not apply well in such cases.

For much of the last century, federal coal had little economic significance, with the majority of U.S. coal production occurring on private lands east of the Mississippi River. But this began to change in the 1970s thanks to the low-sulfur content and low surface mining costs of federal coal lying in thick seams in the Powder River Basin of northeastern Wyoming. The low-sulfur content meant that power plants using Powder River coal could meet the new air quality standards under the Clean Air Act of 1970 without installing expensive "scrubbers" to remove sulfur, as was needed for much of the other coal available in the United States.

Combined with the development of more efficient "unit trains"—long trains that carried coal exclusively from one coal mine to one power plant—the new economics of coal mining and electric power generation resulted in an explosion of federal coal production from 10 million tons in 1972 to 440 million tons in 2002, most of it from the Powder River Basin. As a share of total U.S. production, federal coal went from about 2 percent in 1972 to 40 percent in 2002 and has since remained at about that level.

Besides the transformation of the economics of coal in the 1970s and 1980s, another key part of the story was the speculative leasing of immense amounts of federal coal in the 1960s by the Bureau of Land Management, which was slower than others in realizing its potential future value. In the early 1970s, under attack for what were seen as leasing failures during the previous decade, the federal government suspended further coal leasing in order to develop a new federal coal program that would limit speculation. This proved to be surprisingly difficult, partly because of economic confusions created by the public ownership of such an important natural resource. It was closer to a problem in socialist economic planning than to one of the market economic thinking more familiar in the United States. The result was a long series of missteps in federal coal policy. Unable to find a workable way forward, the leasing of significant new amounts of federal coal was effectively curtailed for about two decades. But ironically, federal coal production rose rapidly during that same period based on production from the 1960s speculative coal leases—the objects of such intense criticism at the time.

In Part I of this study, Robert H. Nelson tells this important but largely untold story of the American energy system—and he is well qualified to do so. From 1978 to 1984, oversight of the federal coal program was Nelson's most important responsibility as a career economist in the Office of the Secretary of the Interior. In 1983 and 1984, he served as the senior economist of the Congressionally mandated Linowes Commission, which reviewed past federal coal leasing practices and made extensive recommendations for a new management program. Nelson, who since 1993 has been based at the School of Public Policy of the University of Maryland, also uses the study to update the key events of the coal program from the mid 1980s to the present day.

The emergence of climate change as a leading environmental issue has led to a new era in federal coal policy. Although it is now possible to remove sulfur dioxide and other conventional pollutants from coal-burning emissions by scrubbing and other means, thus far the technology to remove carbon dioxide emissions at acceptable costs from coal-fired power plants has yet to be found. Up to now, the two primary methods of reducing carbon emissions from power plants have been to either conserve on the use of electric power or to encourage power plants to convert from coal to natural gas. These strategies have achieved substantial successes, and the United States has experienced significant declines in its total carbon emissions. But some environmental activists have pressed for the adoption of another strategy: to limit future carbon emissions by taking government actions to prevent the development of fossil fuel resources in the first place—in other words, to "keep it in the ground," as exemplified by the campaign to block the construction of the Keystone XL pipeline.

In recent years, some leading environmental activists have proposed that this approach be applied to federal coal, and in particular to Powder River Basin coal. In Part II of this study, Nelson critiques this proposed strategy and some of the specific means of implementing it,

such as by significantly increasing the royalty rate for federal coal production. He finds that there would be a number of complications that have so far been overlooked, including the problems associated with monopoly pricing and the possible generation of large excess profits for those few coal companies able to continue mining and selling federal coal.

In the process, Nelson reviews the traditional economic thinking that has gone into the calculation of fair market value and other important influences on the amount of federal coal leased. He concludes that the current circumstances of federal coal in the Powder River Basin require new economic understandings that have thus far eluded government policymakers and many of their outside critics. A particular problem is the effective monopoly of federal coal ownership in the Powder River Basin—a fact that persists while policymakers and other analysts have tried to apply standard methods of analysis suitable for more conventional market settings. Nelson concludes that for federal coal, demand-side actions are much preferred over new supply-side efforts to "keep it in the ground."

Today, the federal coal program is once again subject to prominent policy debate, and with a new presidential administration, this PERC study makes an important contribution in providing historical background and an up-to-date economic discussion of the federal coal program based on Nelson's nearly 40 years of experience in federal coal policy. Nelson's incisive analysis will be of interest to anyone interested in the past or future of coal in the United States.

—Shawn Regan
Research Fellow
Property and Environment Research Center

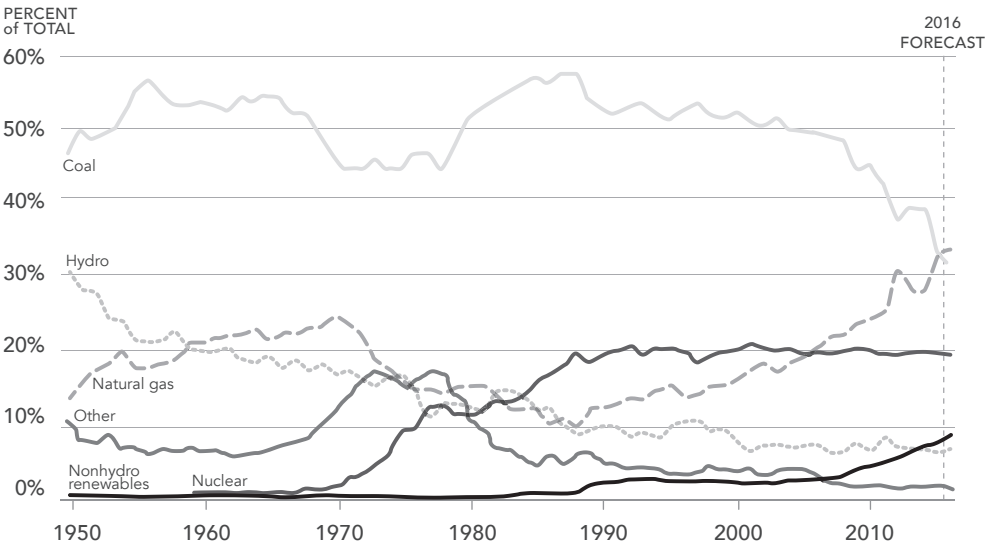
# PART I: A SHORT HISTORY

The United States has more coal than any other nation—with more than one-quarter of the total coal reserves in the world.[1] The federal government itself owns a significant portion of the nation's coal, around one-third of total American coal reserves. From 2001 to 2012, the United States produced more than 400 million tons of federally owned coal ("federal coal" for the rest of this study) annually, equal to around 40 percent of total U.S. production over those years. In 2012, for example, federal coal production was 423 million tons, equal to 41.6 percent of total U.S. coal production.[2]

As shown in Figure 1, from 1980 to the early 2000s, U.S. coal served as the energy source for at least half of the electric power produced in the United States. In the years since, however, it has declined steadily to just 32 percent in 2016. The decline reflects tightening EPA regulation of emissions from coal power plants, growing competition from low-cost natural gas (much of it resulting from the hydraulic-fracturing, or "fracking," revolution), increasing power production from wind, solar, and other renewable sources, among other factors. Given that since 2002 federal coal has remained about 40 percent of total U.S. coal production, federal coal's contribution to total U.S. electric power production has fallen from around 20 percent in the early 2000s to 12 percent today. Even so, federal coal has long been and still remains instrumental—if less so than a decade ago—in meeting the electricity needs of American homes, businesses, and other users.

FIGURE 1

**Annual Share of Total U.S. Electricity Generation by Source (1950-2016)**



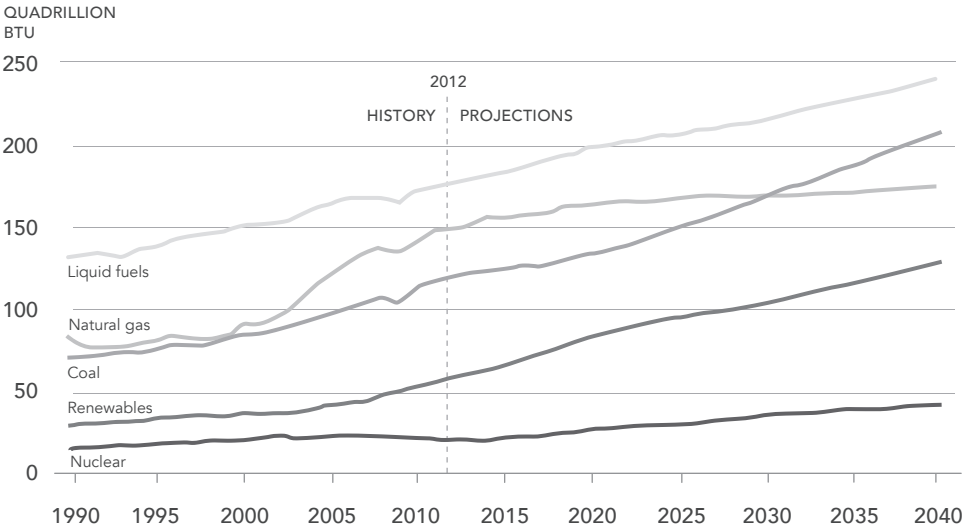

SOURCE: U.S. Energy Information Administration, *International Energy Outlook 2016.*

The largest part of federal coal production takes place in a surprisingly small geographic area.[3] Indeed, about 85 percent of total federal coal production has for many years occurred in the section of the Powder River Basin in northeastern Wyoming (which also extends north into Montana but where federal coal production has been much less than in the Wyoming section). Compared with the rest of the United States, the Wyoming coal mines in the Powder River Basin—all of them surface mines—operate on a far larger scale. A single mine, the North Antelope Rochelle Mine, produced 118 million tons of coal in 2014—almost 12 percent of total U.S. production and more than the total coal production of any state other than Wyoming itself. Of the total North Antelope production, 87 percent was federal coal.[4] A total of only 18 surface mines in the Powder River Basin, which similarly rely predominantly on federal coal, supplied 42 percent of total U.S. coal production in 2014.[5]

The long-run future of federal coal—and, indeed, all U.S. coal—has come into question in recent years. Among fossil fuels, coal not only is the dirtiest to burn in terms of conventional pollutants such as sulfur dioxide and nitrogen oxides, but it also emits about twice the amount of carbon dioxide per unit of energy as natural gas and a third more than oil. If the most commonly accepted climate targets for 2100 are to be reached, most energy modelers argue that there will have to be rapid declines in the use of fossil fuels by the second half of the 21st century. In the shorter run, the Clean Power Plan, a policy the EPA announced in

FIGURE 2

**World Energy Consumption by Source (1990-2040)**




SOURCE: U.S. Energy Information Administration, *International Energy Outlook 2016.*

August 2015 that aims to curb carbon emissions from U.S. power plants, relies heavily on a continuing shift of American production of electric power from coal to natural gas and renewables such as wind and solar. Although its fate is now uncertain following the 2016 Presidential election, the Obama administration's goal to reduce carbon emissions from electric power production by 32 percent from 2005 levels by 2030 would require a sharp shift away from the use of federal and other U.S. sources of coal.

The rate at which coal and other fossil fuels might be phased out in the United States and internationally is the subject of much expert disagreement and controversy. Coal production in the developing world is not likely to decline as rapidly as in the United States. Indeed, India in 2015 announced a goal to double coal production to 1.5 billion tons per year by 2020.[6] Figure 2 shows the most recent estimates by the U.S. Energy Information Administration (EIA) of future sources of world energy consumption until 2040. Natural gas, oil and other liquid fuels, and renewables are projected to show significant growth in their absolute contributions to world energy supplies. Nuclear power is projected to grow as well, but less rapidly. Coal's contribution to global energy consumption is expected to rise slightly until 2020, but coal is the only leading energy source whose production is estimated to stabilize at that level and remain relatively constant from 2020 to 2040. According to the EIA projections, however, it will not decrease.

## REEXAMINING THE FEDERAL COAL PROGRAM

In light of such projections and other related studies, many participants in climate policy debates have concluded that a much more aggressive effort to change the world energy system will be required to stabilize the world's climate than EIA projected as its most likely scenario.[7] The successful environmental resistance thus far to the Keystone XL pipeline, moreover, encouraged many in the environmental community to look for further opportunities to block fossil fuel developments, thereby accelerating the energy transition by "keeping it in the ground." Federal coal has recently become a prominent target for such efforts because the very fact of its federal ownership facilitates direct government management of the future availability of the resource. It would be much more difficult, or perhaps impossible, to adopt a federal policy of "keeping it in the ground" for coal on state and private lands. In 1922, when the State of Pennsylvania sought to ban the development of a private coal deposit altogether, the U.S. Supreme Court ruled—for the first time ever with respect to a government regulatory action—that it would be an unconstitutional taking of private property without compensation.[8]

In January 2016, as environmentalists increasingly aimed to limit the availability of coal and other fossil fuels for production, President Obama announced a suspension of most new federal leasing (other than limited emergency leasing needs to maintain existing operations). Two months later, the Interior Department announced that it would maintain a moratorium on new federal coal leasing for three years while the Department studied its options and prepared a new Programmatic Environmental Impact Statement for its coal management program, intended to set the stage for future coal leasing decisions. Assuming this effort is continued by the Trump administration, this would be the first comprehensive government examination of the federal coal program in more than 30 years.

In 1979, after almost a decade of controversy about the use and management of federal coal, the Interior Department issued a similar Programmatic Environmental Impact Statement announcing the creation of a brand new coal program.[9] Following charges of irregularities in a large 1982 sale of federal coal leases in the Powder River Basin, the next year Congress mandated the creation of the Commission for Fair Market Value Policy for Federal Coal Leasing (better known as the Linowes Commission after its chairman David Linowes). The Commission published a comprehensive economic analysis in February 1984 examining not only fair-market-value issues but also the full workings of the federal coal program.[10] As the Interior Department reviews its options for a Programmatic Environmental Impact Statement for the coal program—the first since 1979—there is much to be learned from the history of the federal coal program.

When it comes to the ability of the Interior Department to design a systematic strategy for leasing federal coal, taking into full account the cumulative impacts of federal coal development on the nation's economy and environment, the Department often failed in its

objectives over the 45 years from 1971 to 2016. Yet the production of federal coal soared from 10 million tons in 1972 to 443 million tons in 2003 (equal to 42 percent of total U.S. coal production that year), and federal production continued to exceed 400 million tons per year until 2013, when it fell to 398 million tons. An important question, therefore, is how the attempts at systematic planning for federal coal's use and management have fared so poorly, yet federal coal over the same years assumed a central role in U.S. electric power production? This Part I of a two-part PERC study will explore the history of the use and management of federal coal. Part II will examine current policy directions and issues.

## FEDERAL COAL IN THE 1970s

As of the early 1970s, very little federal coal had been produced, as shown in Table 1. This reflected the historic dominance of areas east of the Mississippi River, where 568 million tons of coal was produced in 1970, versus only 45 million tons west of the Mississippi. Most federal coal reserves, however, are located in the West, particularly in northeastern Wyoming and southeastern Montana in the Powder River Basin. The rapid rise of federal coal production since the 1970s was closely associated with a large scale shift of coal production in the United States from the East to the West. Wyoming, which had almost no nationally significant role in U.S. coal production in 1970, is now by far the leading coal-producing state in the nation.

The economics of U.S. coal production were transformed by the Clean Air Act in 1970. The Act established strict standards for emissions of sulfur dioxide from new electric power plants. Most eastern coal has a high sulfur content, and thus its use in a new power plant would have required the construction of an emissions control system to remove the sulfur, conventionally known as a "scrubber." Scrubbers are expensive to build, potentially costing as much as a third of the cost of a new power plant—which can often total in excess of $1 billion for the plant.[11] Most of the coal in the Powder River Basin, however, has an unusually low sulfur content. Indeed, the content is so low that it could typically meet the emission standards established under the 1970 Clean Air Act without the use of a scrubber. Compared with eastern coal, Powder River Basin coal also has extremely thick seams, often 50 to 100 feet (10 feet would be a large seam in the East). The Powder River seams are also normally located fairly close to the surface, so the overburden lying above the coal can be more easily removed. Powder River coal can thus typically be produced inexpensively by surface mining methods, costing about $5 to $10 per ton in the 1970s, compared with $30 or more per ton for Appalachian and other eastern coal at that time.[12]

The coal in the Powder River Basin, however, has an economic disadvantage in that it has lower energy content—about a third lower than eastern coal. Its location is also far from most electric power plants, so transportation costs are higher. All things considered, when

TABLE 1

## Total U.S. and Wyoming Federal Coal Production, by Year (millions of short tons)

| Year | Total U.S. Federal Coal Production | Wyoming Federal Coal | Wyoming PRB Federal Coal |
|---|---|---|---|
| 1957 | 5.6 | 0.4 | |
| 1962 | 6.0 | 1.0 | |
| 1967 | 7.2 | 2.1 | |
| 1972 | 10.2 | 2.8 | |
| 1973 | 13.6 | 5.0 | |
| 1974 | 21.5 | 9.5 | |
| 1975 | 26.9 | 14.3 | |
| 1976 | 38.6 | 18.0 | |
| 1977 | 50.4 | N/A | |
| 1978 | 58.8 | 34.7 | |
| 1979 | 59.1 | N/A | |
| 1980 | 69.1 | 33.4 | |
| 1981 | 116.5 | 59.6 | |
| 1982 | 101.1 | 63.6 | |
| 1983 | 105.5 | 68.0 | |
| 1984 | 104.2 | 68.4 (FY) | |
| 1985 | 148.0 | 104.5 (FY) | 89.5 |
| 1986 | 169.9 | 109.5 (FY) | 105.2 |
| 1987 | 180.3 | 113.7 (FY) | 118.2 |
| 1988 | 200.2 | 133.4 (FY) | 136.7 |
| 1989 | 223.6 | 151.7 (FY) | 147.8 |
| 1990 | 237.1 | 164.4 (FY) | 157.9 |
| 1991 | 243.7 | 181.9 (FY) | 167.9 |
| 1992 | 241.0 | 169.4 (FY) | 162.1 |
| 1993 | 261.4 | 178.5 (FY) | 187.0 |
| 1994 | 298.1 | | 209.8 |
| 1995 | 320.6 | | 231.9 |
| 1996 | 329.4 | | 244.0 |
| 1997 | 333.2 | | 243.5 |
| 1998 | 361.4 | | 269.8 |
| 1999 | 386.7 | | 298.0 |
| 2000 | 395.2 | | 310.3 |
| 2001 | 427.5 | | 339.3 |
| 2002 | 440.1 | | 353.2 |
| 2003 | 442.5 | | 360.4 |
| 2004 | 459.5 | | 375.8 |
| 2005 | 440.3 | | 360.2 |
| 2006 | 445.1 | | 366.9 |
| 2007 | 454.8 | | 381.2 |
| 2008 | 487.1 | | 414.8 |
| 2009 | 448.4 | | 386.2 |
| 2010 | 456.9 | | 395.1 |
| 2011 | 451.9 | | 387.2 |
| 2012 | 422.5 | | 349.4 |
| 2013 | 398.0 | | 328.4 |
| 2014 | 409.5 | | 336.4 |
| 2015 | 375.6 | | 310.7 |

SOURCES: U.S. Department of the Interior, *Final Environmental Statement, Federal Coal Program* (April 1979); *Report of the Commission on Fair Market Value Policy for Federal Coal Leasing* (May 1984); *BLM, Federal Coal Management Report*, FY 1993; ONRR, data supplied to the author. Wyoming Federal Coal Production for 1984 to 1993 is for the Fiscal Year (FY). All other production is for the calendar year. Missing figures are due to incomplete data availability.

faced with new Clean Air Act requirements, Wyoming Powder River coal increasingly became the coal source of choice for many new power plants being built in the United States from the 1970s onward, as shown in Table 1.

Reflecting such developments, total federal coal production in the United States rose rapidly from 10.2 million tons in 1972 to 38.6 million tons in 1976 and then 69.1 million tons in 1980 (at that point 8 percent of total U.S. production). About 50 percent of 1980 federal coal production came from the Wyoming Powder River Basin, where the most economically attractive federal coal deposits were located. Then, another major development for federal coal occurred in 1980: the Congressional passage of the Staggers Rail Act, which freed the railroad industry from its longstanding comprehensive regulatory micromanagement by the Interstate Commerce Commission (ICC). It is hard to believe today, but for many decades the ICC had to approve individual changes in fares, routes, and many other fine details of the operation of American railroads. The Act opened up a new era of innovation and management reform in the railroad industry, including the development of unit coal trains of 100 cars or more that were dedicated to running exclusively from one Powder River coal mine to one power-plant user of the coal. The transportation costs of Powder River coal thus plunged; by 1999 these costs had fallen to only about half their 1980 level.[13]

In the newly favorable economic environment in the 1980s, which also included technical improvements in coal-mining methods, federal coal production rose even more rapidly. It increased from 69 million tons in 1980 to 104 million tons in 1984 and 237 million tons in 1990. In the 1980s and then 1990s, federal coal in the Wyoming part of the Powder River Basin rose especially rapidly to supply around 85 percent of total federal coal production by the 2000s.

## ENVIRONMENTAL RESISTANCE TO FEDERAL COAL DEVELOPMENT

As we have been reminded once again in the 2016 presidential campaign, major economic reorganizations of the American economy that result from free trade and other powerful economic forces are likely to be disruptive for many communities and individuals. Even if there are large overall benefits to the nation, those who are adversely affected often protest and resist. Over the course of American history, however, their efforts to hold back the tides of national economic progress were likely to fail. Local dislocation was considered a normal and inevitable part of the "price of progress" of the whole nation.

The environmental movement that arose in the United States in the 1960s and 1970s, however, was less enamored with progress.[14] The "not in my backyard" (NIMBY) motive acquired a new social respectability and legitimacy during this period. Among those most unhappy about the rapid growth of federal coal production in the 1970s in the West—and

the possibility of much more to come—were two groups: American environmentalists and eastern coal mining interests (or, more specifically, miners and their unions and those eastern coal companies that were not well positioned to benefit from the increasing production levels in the West). The combined efforts of these opponents of federal coal development created a strong movement in the 1970s to limit or halt it altogether. It was not then called "keep it in the ground," but the purposes and tactics were similar to the movement of that name today.

The motives of eastern miners and coal companies were clear enough: the protection of their jobs and profits. But those of the environmental movement were less obvious. The struggle to block new federal coal development in the West centered around the Powder River Basin in Wyoming. Unlike other parts of the American West, the Powder River Basin is not a mountainous area with scenic vistas or arid canyon lands with similar attractiveness. Rather, it is a part of the far western extent of the Great Plains that had once been homesteaded—and thus the surface was about 85 percent privately owned, even as the federal government had retained most of the underlying mineral rights, including the coal.[15] Although the region was homesteaded for farming in the early 20th century, long-run changes in weather patterns and other circumstances eventually made it marginal for that use. By the 1970s, the dominant private surface use was livestock ranching.

Thus, by conventional standards, it might have seemed that there would not be much environmental gain in significantly limiting the future development of coal in the Powder River Basin. Indeed, if Powder River coal substituted for eastern private coal that often was found in more mountainous and scenic areas closer to large populations, there might have been a net environmental gain. Owing to the great thickness of Powder River coal seams, much less land area in total would be disturbed by surface mining in Wyoming as compared with surface mining a similar amount of coal in Appalachia, where a significant amount of coal was also surface mined. As compared with underground mining in the East—still the leading method there—Powder River coal posed less risk of accident and otherwise to the health of miners. With its low sulfur content, the use of Powder River coal also worked to reduce significantly the national environmental costs of complying with the Clean Air Act of 1970.

Nevertheless, beginning in the 1970s many environmental organizations strongly opposed further development of Powder River and other federal coal in the West—even as they saw existing coal mining in the East, especially surface mining, as environmentally destructive. What then was the reason for the intense environmental opposition? To some extent, environmentalists seemed to think that the areas of eastern coal mining were already a lost cause, which made it all the more important to avoid a repetition in areas of the West that had thus far largely been spared the destructive environmental impacts of surface coal mining.

All forms of intensive energy development, moreover, are particularly susceptible to being depicted in moralistic terms. From the Arctic National Wildlife Refuge to the Powder River Basin, whether accurate or not, environmental imagery routinely characterized new oil and gas and coal development as occurring in "pristine" areas where it was "raping" the land—a longtime staple of environmental fundraising letters in particular.

It was not only the wildlife and other natural features of the Powder River Basin that environmentalists saw as coming under assault by rapid new federal coal development but also the historic ranching culture of the region. Environmentalists often fought to limit grazing on public lands in other places. In this case, however, ranchers seemingly became cultural icons. Environmentalists were also resistant to the idea that any such environmental costs in the West would have to be weighed in a trade-off against the large national economic benefits of low-cost and low-sulfur coal production as well as the environmental benefits in the East, where less mining would occur.[16]

In any case, motivated in the 1970s by a zeal to protect the natural world and the historical non-coal culture of the Powder River Basin, environmentalists adopted the tactics of activism as they had been improvised by David Brower and others in the 1960s and 1970s.[17] Seeking to maintain an existing moratorium on new federal coal leasing dating to 1971, for example, they filed suit against the Interior Department's compliance with the National Environmental Policy Act (NEPA), persuading a federal judge in 1977 to extend the moratorium until the Department had completed an adequate "programmatic environmental impact statement" (PEIS) for its entire federal coal planning and management program.

## APPEALING TO THE LOGIC OF FEDERAL COAL "SCIENTIFIC MANAGEMENT"

In the media, fundraising letters, and other forums, environmental organizations sometimes explicitly employed religious language such as the "sacred" character of the land that would be "defiled" by "evil" coal development.[18] They recognized, however, that such language might not have as strong an appeal outside their circles, so it would thus be desirable to make more widely acceptable arguments. A leading such argument was that there was no real economic "need" for further federal coal leasing. Environmentalists pointed accurately to the very large amounts of federal coal that had been leased by the Interior Department in the 1960s—more than 15 billion tons in fact, compared with annual federal coal production at the time of less than 10 million tons. Very little of the coal leased in the 1960s thus had been developed; instead it was being held for speculative purposes. Although "speculation" can be seen in positive economic terms as a rational means of allocating resource use over time, for many people it is also a term charged with moral significance. Much as usury was long condemned in Western religion and philosophy, the idea of making money by

holding land and natural resources out of production and thus keeping the resources unused for profit-making purposes is still offensive to many people today.

Environmentalists and other critics thus played on such sentiments by charging that the 1960s Interior Department lease activities had amounted to a "giveaway" to private speculators who had been better informed about actual future federal coal prospects than the BLM officials then running the federal leasing program. There were also about 9 billion additional tons of federal coal potentially available in the 1970s if private holders took advantage of a leasing practice authorized by the Mineral Leasing Act of 1920: the private filing of "preference right lease applications" in specified areas where the presence of commercially developable coal was not known to exist. If an applicant subsequently demonstrated that coal did in fact exist in the area, the application could then be converted into a new federal coal lease.[19] It was a federal coal version of the Mining Law of 1872 under which claims could be filed for "hardrock" minerals such as gold and copper and ownership obtained by demonstrating the presence of a commercially viable deposit. The filing of the similar preference right lease applications was another method widely used in the 1960s of speculatively gaining potential future rights to develop federal coal.[20]

It was not only environmentalists, moreover, who argued against new federal coal leasing on the grounds that no clear national need for it had been demonstrated. In 1976, the General Accounting Office (GAO) wrote:

> We believe that some fundamental attempts should be made… to relate the amount of Federal coal required to meet national goals to any program of renewed leasing. At this stage we do not know how much coal is expected from the federal lands, how much is already under lease that can meet such an expectation, or how much more, if any, should be leased.
>
> Specifically, we believe that the Secretary of the Interior should more precisely identify what role should be played by Federal coal resources in meeting national coal production goals.[21]

Others opposed to federal coal development would similarly argue that new federal leasing required a rational government plan that clearly demonstrated the need for the production of federal coal. The nonprofit Powder Basin Resource Council thus would argue in 1978 that "accurate determination of need is critical to the residents of the Powder River Coal Region, who will be the most severely affected by the implementation" of Interior's new coal leasing program. As a result, "even in a scaled down form… we have to know that when additional coal leasing takes place in the Powder River Basin, it will be predicated on the

most realistic assessment of demand and that all reasonable alternatives for meeting that demand have been exhausted."[22] Since there was in practice no economically sound way that this "demand" or "need" could be reliably and accurately shown, such language effectively amounted to a demand to keep currently unleased federal coal in the ground.

Since the spread of local zoning across the United States in the 1920s, virtually all legal theorists had insisted that zoning had to be implemented "in accordance with a comprehensive plan"—a way of ensuring that the allocation of valuable land-development rights was rationally justified in the public interest and did not serve narrow private purposes (much like federal coal development rights in the 1970s and 1980s).[23] By the 1960s, however, professional planners and most other students of U.S. land use regulation widely recognized that this requirement for proper zoning practice had become little more than a legal and political fiction. The late-1970s attempt to write a rationally comprehensive plan for future federal coal development proved to be no less fictional. As Friedrich Hayek (among many other economists) famously argued, in the real world it would take immense amounts of information in the hands of national or local government planners—more than is possible in practice—to achieve workable national planning of the economic future of major industries such as U.S. coal.

Admittedly, the ideological conviction that the key means of production in society should be publicly owned was widely held over the course of the 20th century (a part of what I have called a particular form of "economic religion.")[24] The core idea was that the government must plan for the levels of economic production needed throughout the various key economic sectors in society. Then, the administrators of the government-owned means of production should produce according to the specifications and other details of these plans. Such thinking reflected a wide and deep wish to dispense with trial and error methods, social disruptiveness, potential inequality, speculative activities, and other "unsavory" aspects of the workings of private market processes.

Indeed, such ideas were taken seriously enough that they were put into wide practice in Europe in the early and mid-20th century. But they did not gain much traction in the United States, where in their purest form they would have required widespread nationalizations of private property. The one-third of U.S. coal reserves owned by the federal government, however, was a large exception in that this key resource was already in government ownership. Indeed, the government ownership of coal offered the United States one of the few opportunities in the 20th century to put Progressive-Era ideals of the scientific management of publicly owned resources—an American variation on European socialist ideals—into practice.[25]

The thrust of the widely proposed coal program reforms in the 1970s was thus to calculate future national energy needs, the overall role that coal would play in meeting

these national needs, the particular role of federal coal, the best regions in the West for the production of federal coal, and the specific federal coal tracts in each region that were most suitable for development and thus leasing. It would all be designed to maximize national welfare by scientifically meeting national energy objectives from the bureaucratic top down to the bottom levels of federal coal tract selection. When the Interior Department released its final Programmatic Environmental Statement for its coal program in 1979, this was the guiding spirit for the newly established program. As laid out in the PEIS, the Department of Energy fulfilled its assigned role by developing a national energy model that could predict future energy and coal production from national aggregate levels down to disaggregated regional levels. Interior coal program managers would then use these DOE projections as surrogates for the future "need" for federal coal and thereby establish the federal leasing requirements in each federal coal region in light of such needs. While they would never have described it this way, it was in fact the development of a comprehensive U.S. national plan for future energy and coal production, including federal coal.

By that time, Europe was rapidly abandoning its own prior experiments in socialist ownership of the means of production. Privatization and deregulation were instead coming into vogue around the world. There was a growing recognition among economists and other policy professionals that a regime of comprehensive national planning goals and production targets was likely to fail, as had been amply demonstrated in practice by past European and other experiences. However, such ideas had not penetrated the thinking of the most influential designers or the leading critics of the federal coal program in the West. Environmentalism did not really come to terms with economics until the 1990s with the acceptance of cap-and-trade policies and other market-based ideas.[26] As late as 1991, one environmental philosopher would write about "Why Environmentalists Hate Mainstream Economists" in the scholarly journal *Environmental Ethics.* The 1970s, therefore, was hardly a good starting point for doing sound policy thinking about as central an economic question as federal ownership and management of a third of the coal reserves of the United States.[27]

## TWO 1977 CONGRESSIONAL INTERVENTIONS

Although the large amounts of federal coal speculatively leased in the 1960s were widely criticized in the 1970s, they turned out to be the only significant source of federal coal available for development until the 1990s. By 1979, despite a decade of virtually no new federal coal leasing, there were about 17 billion tons of this earlier-leased federal coal still under lease. New federal coal leasing did resume in 1981, but it was short lived. Thus, although more federal coal was leased in the 1980s than the 1970s, it was still minimal relative to the rapidly growing levels of production of federal coal.

In the 1970s and 1980s, there were actually two parallel federal coal programs. One was the "scientifically managed" program of federal coal leasing, with its national energy production goals and regional federal coal leasing targets that was the official program of the Interior Department, as announced in 1979. The other was the program to manage the 17 billion tons of federal coal already under lease (almost all leased before 1971), including most crucially the 11.5 billion tons of this coal that were surface minable. In the Powder River Basin alone, as of 1979 there were 8.9 billion tons of surface-minable coal in existing leases that dated to the 1960s.[28] If all this coal went into production, assuming a typical mine life of 20 years, it would be capable of sustaining a rate of federal coal production of more than 400 million tons per year for a full 20 years.

There were also another estimated 9.9 billion tons, including 3.5 billion tons of surface-minable coal, that at least in concept could be rapidly converted into a federal lease by the holder of a preference right lease application (as discussed above). Of the surface-minable coal, 1.6 billion tons were in preference right lease applications in the Wyoming Powder River Basin and thus had better prospects of eventually becoming a new federal lease (without any affirmative leasing decision on the part of the government).[29] The holder of a preference right lease application could hold it indefinitely until ready to seek to convert it into a new federal coal lease.

Congress had banned speculation in future new federal coal leases in 1976 by requiring that a federal lease must begin commercial development within 10 years of its issuance or be surrendered for failure to meet the "diligence requirement." It was uncertain, however, how the diligent-development requirement would apply to federal coal leases issued prior to 1976. At a minimum, the grandfathered 1960s leases could be held for 10 additional years beyond 1976. These leases, with their large amounts of federal coal reserves, would thus be available for development at least until then, and perhaps longer depending on legal outcomes. Indeed, as shown in Table 1 previously, the levels of production of federal coal rose rapidly in the 1980s, reaching 237 million tons by 1990—despite very little new federal coal leasing since 1971 (see Table 2).

The fierce and long-lasting public controversy about new federal coal leasing was thus of less practical significance than it seemed for many people at the time. Indeed, it might perhaps best be described as a form of "public theater." "Raping" the lands of the West for the purpose of developing fossil fuels—especially coal—was seen to be morally wrong; there were many people who wanted to find a way to say so loudly and publicly but felt the need for more technical-sounding language of federal coal demands and supplies to express their outrage.[30]

Bending to strong public pressures to limit the development of federal coal in the West, Congress took two steps in 1977. As noted above, most of the federal coal in the Powder

River Basin lies beneath privately owned surface land. The private owner is usually either a coal company that has purchased the surface land or a longer-term cattle rancher. Until 1977, the holder of the federal coal subsurface rights had the legal right to develop the underlying coal, as long as payment of compensation for damages to the surface owner was made. In 1977, however, Congress enacted the Surface Mining Control and Reclamation Act (SMCRA), establishing federal regulation and oversight of surface coal mining in the United States. SMCRA included a provision that henceforth required the consent of a rancher surface owner before the underlying federal coal could be leased.[31] If the coal was not already leased it could not be leased in the future without the consent of the rancher, potentially fulfilling the 1970s environmental goal to—in today's language—"keep it in the ground."

Of course, if the federal coal was valuable enough, a coal company could offer a few million dollars for the rancher's consent, and many ranchers would be willing to—and often did—accept. This workaround thus limited the usefulness of "surface owner consent" in slowing or halting federal coal leasing and development. Since consent had to be purchased before the lease sale, coal companies, however, would limit their consent purchases to federal coal tracts where they had significant bidding advantages (adjacent, say, to an existing mine and lease of a particular coal company). For coal tracts where no one coal company had a special advantage, and where there was a rancher surface owner, there would be little incentive for any coal company to purchase the necessary surface-owner consent prior to leasing. Any such advance purchaser of surface-owner consent before a lease sale would in essence be providing a collective benefit to all other coal companies by making the underlying federal coal available for leasing.

Surface-owner consent created a significant obstacle to the government offering new stand-alone coal tracts (or sets of tracts) capable by themselves of supporting a brand new mine that might therefore attract significant bidding competition. In the 1976 Federal Coal Leasing Amendments Act, Congress said, on the one hand, that it was seeking greater bidding competition for federal coal leases and one year later in SMCRA, on the other hand, Congress was acting to significantly undermine this goal. This created obstacles to holding stand-alone coal lease sales and generating greater competitive bidding—a problem which still exists today.

Where a particular coal company did have significant individual bidding advantages because a federal coal tract was adjacent to one of its existing mines and thus valuable only to this particular company (a widespread circumstance), it would of course be willing to purchase the necessary surface-owner consents and to encourage government sale of the lease. In such cases, however, the effect of the law would still be to depress government revenues because of the additional cost to the coal company of purchasing the consent. Ironically,

given the urgent demands of the 1970s that the government obtain fair market value for its coal—a concern that continues today—in 1977 Congress effectively gave rancher surface owners a part of the right to develop the underlying federal coal, and thus effectively gave away some of the monetary value of the federal coal itself.

## THE CLEAN AIR ACT AMENDMENTS OF 1977

A second step taken by Congress in 1977, however, would prove more effective in slowing the development of federal coal in the West. As explained above, the Clean Air Act in 1970 had transformed the economics of the production and use of western and federal coal by electric utilities, favoring the use of Powder River Basin coal because it could meet the sulfur emission standards of the Act without the costly installation of a scrubber. But what if the Clean Air Act were amended to simply require that all power plants in the United States must install scrubbers, whatever the sulfur content of the coal? Since power plants would then have to pay for scrubbers even when they served little practical purpose, this would significantly undermine the new 1970s economic rationale for using low-sulfur Powder River coal and thus slow the development of coal in the West.

From a national economic point of view, this would be about like shooting yourself in the foot—to require coal scrubbing for many new power plants that could meet the Clean Air Act standards without scrubbing and at less cost by burning coal that had little sulfur. But there are many motives in politics beyond national economic efficiency. Economist Bruce Yandle famously described the old southern alliance of "the bootleggers and the Baptists"—the Baptists promoted prohibition and the bootleggers were happy to help them because they made money from prohibition.[32] In this case it was not Baptists but environmentalists that were strongly opposed to western coal development who provided the moral indignation. The bootleggers with a powerful economic interest in blocking western and federal coal development were eastern coal miners and those eastern coal companies with major mining investments whose value might be undercut. Remarkably, this alliance prevailed in 1977; as part of a much wider set of amendments to the Clean Air Act, Congress included a provision requiring that all future new U.S. power plants must scrub their coal emissions to some extent—regardless of the sulfur content of the coal.

Thanks to the efforts of Bruce Ackerman, a professor at the Yale Law School, and William Hassler, an EPA attorney, this legislative outcome became famous—or rather infamous—in the annals of environmental history and would eventually be repealed in 1990. In their 1981 book *Clean Coal, Dirty Air,* Ackerman and Hassler found that the results of the 1977 Congressional handiwork would not only waste billions of dollars on unneeded scrubbing of power plant emissions, but it would also have an overall negative impact on air quality in the United States. As they wrote, mandated scrubbing for all new power plants "is not only

a costly way of providing the next generation with outdated [emissions control] machinery, but it will expose many northeasterners of the present generation to greater sulfur oxide concentrations than they would otherwise suffer." All in all, Ackerman and Hassler found this to be an environmental policy "fiasco."[33]

In the halls of Congress, the authors reported, the universal-scrubbing provision had resulted from the combined efforts of "two very different actors" who had nevertheless found in this new requirement "a plausible solution to their political problems." For eastern coal interests, they explained, "the scrubber secured [their] markets against western competition. For environmentalists, it promised to provide additional protection to pristine areas in the West." (It was admittedly a stretch to imagine the Powder River Basin of 1977 as a "pristine" area.) Scrubbers also seemingly appealed to some people who viewed them as another of the "technological symbols" that marked the general scientific and economic progress of the world.[34]

In their book, Ackerman and Hassler drew some wider conclusions about the failings of the American political system, illustrated by this particular episode in the history of environmental policy. As they wrote of Congress:

> Our story is rich with symptoms of acute breakdown that suggest general lessons about the effort to move beyond the New Deal style of public administration [as had recently been reflected in the revolution in environmental law of the 1970s]… Our scrubbing story reveals a complete failure by the Congress to fulfill the functions it is uniquely equipped to handle in our system of government.[35]

## MORE FEDERAL COAL FOLLIES

It had been a steep learning curve, but the Interior officials and others involved with federal coal policy had come a long way by the end of the Carter administration. They had moved beyond coal-policy moralism to incorporate an important economic dimension into their thinking as well. When they left office in January 1981, however, a new and inexperienced Interior team of federal coal program managers arrived with the Reagan administration that had to start all over again, at the bottom of its own learning curve. Indeed, by the end of the first Reagan term, following various mishaps, federal coal leasing was in crisis again as Interior officials were seeking to dig themselves out of the deep political and policy holes. One of the casualties was James Watt, who was fired as Secretary of the Interior in 1983 after a series of verbal blunders.

As a result, I had an unusual opportunity, and also in many ways one of the most interesting and informative experiences of my 18 years in the Interior Department. The Congressionally mandated Commission for Fair Market Value Policy for Federal Coal Leasing, better known as the Linowes Commission, had little money, so much of the staff had to be detailed

from federal agencies, mostly from the Interior Department. From my position as a senior economist in the Office of Policy Analysis in the Office of the Secretary of the Interior, I had been closely involved since the Carter administration with the development and implementation of the new federal coal leasing program announced in 1979, which held its first coal lease sale in 1981. Moreover, with Watt gone and other top Interior officials associated with the coal program in political trouble, I also had little to lose in ruthlessly assessing and presenting what I saw as its problems and possible solutions.

Although they had not been as involved with the coal program, two other Interior policy analysts—Ted Heinz and Donald Bieniewicz, who I had worked with for many years in the Office of Policy Analysis—also joined the commission staff. Together, the three of us comprised the main economic staff and wrote large parts of the initial drafts of the commission's report. The report—all 639 pages of it—was released in February 1984, and it has proved to have a long shelf life. It remains a part of federal coal program history that is now resurfacing in light of the increasing levels of scrutiny of the federal coal program today.

The Reagan team in the Interior Department in 1981 was anxious to show its commitment to federal coal development and to move forward rapidly with plans to resume federal leasing. With the large amounts of federal coal already under lease, there was no strong case that in absolute terms more federal coal needed to be leased. There was, however, a valid case for new coal leasing: economically and environmentally superior federal coal tracts might remain unleased, and leasing them could displace higher-cost and otherwise inferior coal tracts that had already been leased. But the leasing of federal coal again took on a greater symbolic meaning in the Reagan administration; new federal coal leasing would represent a repudiation of the environmental resistance to federal coal development that had characterized much of the 1970s and symbolize a renewed dedication to the use of federal natural resources to serve the economic progress of the nation.

As a start, a total of 405 million tons of federal coal were leased in 1981, but the centerpiece of the newly aggressive Interior leasing program was a planned large federal coal lease sale for the Powder River Region in 1982. Initially, the goal was to lease up to 2.2 billion tons, but in the end only about 1.5 billion tons were leased. More importantly for future coal leasing in the 1980s, top Interior officials were soon being publicly accused of serious irregularities in the conduct of the Powder River sale, resulting in Congress creating the Linowes Commission in 1983.

The political problem for the recent arrivals in the Interior Department in the spring of 1982 was that the market for federal coal leases was rapidly softening. In our detailed account of events leading up to the April 1982 Powder River sale, the Linowes Report observed that in "early March, [the Minerals Management Service] 'began to hear rumors that the value of coal lands had taken a sharp drop.' The Deputy Minerals Manager for Resource

Evaluation in Casper [Wyoming] contacted five people with knowledge of coal land values who 'all expressed the opinion that the market for coal lands was down about 50 percent and that low-sulfur Wyoming coal was no longer a premium item."[36] When this information reached top political appointees at Interior who were overseeing the federal coal program, it is fair to say that they panicked. They had been determined to demonstrate in a publicly visible way that the Department could successfully move forward with aggressive federal coal leasing after a 10-year moratorium, and the Powder River sale was critical to this effort. Yet, owing to the rapid softening of the market for new coal holdings, they then feared that the Powder River sale might fail—and it was at least conceivable that no federal coal would be leased at all.

A main part of the Interior problem was that the government's estimate of fair market value for the Powder River sale had been calculated a few months in advance, before the sudden market softening. According to the federal coal program that had been years in the making—and as Congress in 1976 had legally mandated—federal coal must not be leased at less than "fair market value," a requirement that might have been impossible to meet in the Powder River Basin in the spring of 1982 given the sudden market weakening, which was not reflected in the official fair market value numbers that had been calculated before it had occurred. With only a month before the Powder River sale, top Interior coal program managers desperately searched for a solution—how to reduce the minimally acceptable bid below the previously calculated fair market value appraisals for the leases to be offered. They might well have simply postponed the sale until the market for federal leases improved. Instead, hastily and with little staff input, these top political appointees at Interior in late March contrived a brand new concept: a "minimally acceptable bid" that would be announced prior to the sale and that would take the place of the previous role of fair market value appraisals in determining bid acceptances. On average, as the Linowes Commission later reported, Interior's newly published minimum acceptable bids were about 50 percent lower for the Powder River lease offerings than the previously calculated fair market value appraisals.[37]

Given the legal requirement for fair market value, in effect the Interior Department had simply reduced the lease appraisals by on average 50 percent for the practical purpose of having a successful Powder River sale—and it did so one month before the biggest lease sale in the history of federal coal. In the end, of the 13 tracts offered in the April 1982 Powder River lease sale, two received no bids, eight received one bid, and three received two bids. The government accepted 10 of the high bids and rejected one. It later successfully re-offered two tracts in October 1982, resulting in 1.5 billion tons of federal coal leased in 1982 in the Powder River Basin—the most since the 1960s. But in the end, all hell broke loose.

Not surprisingly, word of all these last minute changes and other irregularities soon leaked to the trade press and then the wider media, evoking memories of the Teapot Dome oil

lease scandal (also in Wyoming) of the 1920s. There is no evidence that any of the Interior officials were personally bribed, but the public appearance they created could hardly have been worse, eventually leading to the Linowes Commission and the departure of the top political appointees at Interior responsible for the federal coal program. Once again, just a few years after the announcement of a brand new coal program, federal coal leasing was in crisis and turmoil.

In 1994 the General Accounting Office (GAO) summarized what had been learned since the new Interior coal program was announced in 1979. As GAO reported, "it can be extremely difficult to accurately predict the demand for coal, and the further into the future the forecasts are extended, the more unreliable the predictions become." In 1978, the DOE's most likely projection for 1990 total U.S. coal production, for example—intended to be a main basis for estimating federal coal needs and thus setting federal coal leasing levels during the 1980s—turned out to be 70 percent higher than the actual outcome. As GAO stated, the lesson was that "if BLM sets coal-leasing levels strictly on the basis of the projected future demand for coal, it risks offering and evaluating more (or fewer) leases than the number that will sell."[38]

Such unworkable elements of the 1979 Interior program were thus becoming increasingly apparent during the 1980s. World oil prices had declined precipitously from their early 1980s levels, affecting other energy markets as well. Combined with weakened demand for new federal coal leases, the practical result was virtually a new moratorium of the 1980s. From 1984 and the release of the Linowes Commission report until 1990, no new federal coal leases were sold in the Powder River Basin, and the number of new federal leases sold elsewhere never exceeded five in any year.[39] As shown in Table 2, from 1984 to 1990 the amount of newly leased federal coal reserves was minimal in some years (6.2 million tons in 1985 and 0.9 million tons in 1988) and never exceeded the annual level of total federal coal production in any of those years. By comparison, federal coal reserves in existing leases in 1984 totaled 17.6 billion tons, the great majority contained in leases dating to the 1960s.[40] Over the same period, as shown in Table 1, federal coal production from these existing leases soared at a growth rate of 14.5 percent per year.

By 1990, there was new leadership at the Interior Department under the George H. W. Bush administration. After 1984, the federal coal program gradually receded from the headlines partly as a result of low leasing levels, and federal coal was no longer a leading public issue for the environmental movement. Environmentalists could do little to block the development of existing coal leases, thus making this a less attractive public cause. Looking back over the coal leasing history of the 1970s and 1980s, the Bush team could see in essence two decades of conceptual confusion, misplaced hopes, inept administration, comprehensive energy planning that typically proved to be far off the mark, coal production projections that soon were proven wrong, few new leases sold (except in the disastrous 1982 Powder River sale), among other failures.

TABLE 2

## Newly Leased Federal Coal Reserves, Total U.S. and Total Wyoming, by Year (millions of short tons)

| Year | Total New Federal Lease Reserves | New Federal Lease Wyoming Reserves |
|---|---|---|
| FY 1978 | 3.4 | |
| FY 1979 | 70.8 | |
| FY 1980 | 135.6 | |
| FY 1981 | 295.6 | |
| FY 1982 | 1,406.9 | |
| FY 1983 | 996.1 | |
| FY 1984 | 70.2 | |
| FY 1985 | 6.2 | |
| FY 1986 | 124.1 | |
| FY 1987 | 12.5 | |
| FY 1988 | 0.9 | |
| FY 1989 | 84.0 | |
| 1990 | 34.8 | 0.3 |
| 1991 | 169.3 | 102.6 |
| 1992 | 863.8 | 851.0 |
| 1993 | 91.7 | 55.0 |
| 1994 | 62.3 | 0.0 |
| 1995 | 214.1 | 164.4 |
| 1996 | 130.7 | 60.4 |
| 1997 | 172.5 | 157.6 |
| 1998 | 957.1 | 944.0 |
| 1999 | 153.5 | 65.9 |
| 2000 | 407.5 | 275.6 |
| 2001 | 21.8 | 0.0 |
| 2002 | 544.8 | 537.5 |
| 2003 | 7.6 | 0.0 |
| 2004 | 1,709.3 | 1,678.5 |
| 2005 | 370.5 | 359.3 |
| 2006 | 115.4 | 0.0 |
| 2007 | 225.8 | 11.2 |
| 2008 | 543.1 | 543.1 |
| 2009 | 59.6 | 54.7 |
| 2010 | 0.0 | 0.0 |
| 2011 | 981.3 | 981.3 |
| 2012 | 1,166.1 | 1,123.4 |

SOURCES: For Fiscal Years 1978 to 1989, BLM, *Federal Coal Management Report*, FY 1989; for Calendar Years 1990 to 2012, GAO, *Coal Leasing: BLM Could Enhance Appraisal Process, More Explicitly Consider Coal Exports, and Provide More Public Information* (December 2013). Missing figures are due to incomplete data availability.

Indeed, the closest thing to an Interior Department coal program success was the large amounts of coal leased in the 1960s that had in effect saved the day in the face of the many federal coal follies, including allowing federal coal production to respond to rapidly growing market demands for low-sulfur coal in the 1980s. As long as the large 1960s inventory of leased federal coal remained (increasingly contained within producing mines), there might be superior deposits of unleased coal elsewhere that would have had lower mining costs and created greater competition among coal companies to supply power plants, but the large amounts of undeveloped federal coal already under lease were sufficient to sustain the rapid increases in the 1980s of federal coal production in the Wyoming Powder River Basin.

## THE 1990s AND 2000s: LEASING BY APPLICATION

As conceived in the 1970s coal program design, the original expectation had been that the Interior Department would offer leases to support the development of a number of brand new mines, thus generating active bidding competition among multiple coal companies—as had long been the routine practice in offshore oil and gas leasing in the Gulf of Mexico, for example. But there were various obstacles to such a coal leasing program. As noted above, for rancher-owned surface lands, consents would have to be obtained in advance of leasing, but there was little incentive for any coal company to undertake this task for a stand-alone coal tract capable of supporting a new mine (and the government was not willing to negotiate and pay for surface-owner consents prior to sales). Although the federal government owns the great majority of the coal in the Wyoming Powder River Basin, this federal coal is nevertheless commonly intermingled with smaller tracts of state-owned coal and sometimes with private coal as well. It might well therefore be difficult to offer for sale a stand-alone mining opportunity that would not also depend on further non-federal coal acquisitions after the sale. Again, it might have been logical to pool the federal, state, and private coal to create a unitized "logical mining unit" for joint sale, but the federal government never seriously considered entering into such leasing partnerships.

The federal government also lacked good information on the relative economic attractiveness of potential stand-alone mining sites. Before a coal company could make a well-informed bid, it would have to consider relative mining costs, necessary transportation arrangements, and potential power plants that might be interested in contracting for the coal—again, something outside routine government knowledge and expertise. In short, it was often necessary to rely on coal companies for such critical information, and coal companies might be willing to assemble and publicly divulge such information only where they would be likely to have a bidding advantage for a coal tract.

A major development for federal coal leasing was the enactment in 1990 of the Clean Air Act Amendments that finally ended the notorious universal scrubbing requirement of

the Clean Air Act Amendments of 1977. The scrubber requirement had inhibited the use of federal coal in the 1980s, but the combined use of federal and non-federal coal blends could still alter the method and reduce the cost of scrubbing, thus helping to sustain the large increases of federal coal production in the 1980s. In the 1990 Act, however, Congress authorized a whole new market-oriented cap-and-trade system in which existing electric power plants and other existing sulfur dioxide ($SO_2$) emissions sources would be given "allowances" to emit $SO_2$ and could purchase additional allowances from others at their discretion. New power plants would have to purchase all the allowances they needed. Any sulfur emissions source above a certain size had to limit its $SO_2$ emissions to its allowance holdings. It did not make any difference how it kept its emissions within that limit, whether by burning low-sulfur coal from the Powder River Basin, using a scrubber, or any other method.

Facing a likely increase in demand for low-sulfur federal coal, and showing an element of common sense often missing in the previous history of the federal coal program, the Interior Department in 1990 jettisoned the nationally planned, cumbersome, and in many ways unworkable coal program that had been announced with such fanfare in 1979. In a 2016 background summary introducing its forthcoming comprehensive review of the federal coal program, the Interior Department candidly acknowledged that "the regional leasing program authorized in the 1979 regulations has not worked." Instead, since 1990 "the BLM has conducted leasing only in response to industry applications."[41] Officially, this meant that the Powder River and other coal regions were "decertified," eliminating the many regulatory requirements that were in effect for "certified" federal coal regions. Under the newly adopted 1990 approach, individual coal companies would submit individual applications for a lease to a specific coal tract—almost always a tract within or adjacent to the boundaries of an existing mine. The BLM would then do a review and determine whether to offer that specific tract for lease.

With this radical simplification, Interior finally achieved a workable approach to federal coal leasing. As shown in Table 2, federal leasing levels rose significantly in the 1990s and further still in the 2000s. This provided the basis for a more routine replenishing of federal coal supplies, as the rapidly rising rates of federal coal production in the 1980s and 1990s meant that there was a diminishing supply of previously leased federal coal. From 2002 to 2012, for example, total federal coal production equaled 4.9 billion tons. During this same period, total newly leased reserves of federal coal equaled 5.7 billion tons, about 15 percent more than the amount of coal produced over that period. Hence, total federal coal reserves under lease did not change radically, despite levels of federal coal production equal to around 40 percent of total U.S. coal production. Selling new leases, as opposed to developing the much older inventory of existing federal leases, also brought in significant amounts of new revenue to the federal government.

In terms of numbers of leases, a total of 111 federal coal leases were sold from 1990 to 2012, including most importantly 28 in the Powder River Basin in Wyoming. These Powder River leases contained the great majority of the newly leased coal reserves (7.7 billion tons) for which coal companies paid a total of $5.4 billion in bonus bids (a 12.5 percent royalty would also be paid later once production began, ultimately generating the largest part of long-run total lease revenues). The single largest individual lease sold since 1990 was 721.1 million tons, for which $793.3 million was paid in 2012 by the Peabody Energy Company, the owner of the nearby North Antelope Rochelle coal mine.[42] In 2012, the power plant destinations for Wyoming coal—almost all of it from the Powder River Basin—included 34 states; Texas received the most (14.3 percent), followed by Illinois (13.3 percent) and Missouri (10.8 percent).[43]

Released from the legal constraints of the 1977 scrubbing requirement for new power plants, with sulfur control requirements now also imposed on existing power plants, with unit trains having reduced transportation costs sharply, and with new federal coal becoming available to coal companies, total U.S. production of federal coal skyrocketed from 239 million tons in 1992 to 440 million tons in 2002, reaching 40.2 percent of total U.S. coal production that year. Most of the federal coal production in 2002 and subsequent years was in the Wyoming part of the Powder River Basin and mined by a handful of major coal companies operating immense surface mines. Federal coal production reached its peak in 2008 at 487 million tons, and it reached its peak in terms of its percentage of total U.S. coal production in 2010 at 42.1 percent. It has since declined to 376 million tons of federal coal and 41.9 percent of national production in 2015. As of 2011, there were 7,000 jobs in Wyoming that were directly attributable to the coal industry; on average each Wyoming coal mining job paid $82,654 in annual earnings in 2013, as compared with a Wyoming statewide average of $44,977.[44]

## AN ECONOMIC AND ENVIRONMENTAL SUCCESS STORY

The $SO_2$ cap-and-trade system authorized by the 1990 Clean Air Act Amendments has been widely praised as an economic and environmental success story. Indeed, when the House of Representatives passed the Waxman-Markey cap-and-trade bill for carbon emissions in 2009 (which never made it through the U.S. Senate), it was commonly seen as an attempt to further extend the lessons of the 1990s $SO_2$ cap-and-trade system to the climate impacts of carbon dioxide. By then it was not only leading environmental (and other) economists who favored cap and trade, but much of the environmental movement as well. The major economic and environmental successes of the $SO_2$ cap-and-trade program were heavily dependent on the large amounts of low-sulfur Powder River coal available from federal lands in the 1990s and 2000s. With supplies of federal coal leased in the 1960s declining,

federal coal leased after the introduction of the new leasing approach in 1990 based on coal company applications played an increasing role.

In 2012, two leading energy and environmental economists, Richard Schmalensee and Robert Stavins, wrote that "by the close of the twentieth century, the $SO_2$ allowance trading system had come to be seen as both innovative and successful. It has become exceptionally influential, leading to a series of policy innovations in the United States and abroad to address a range of environmental challenges, including the threat of global climate change."[45] For one thing, "the program was environmentally effective, with $SO_2$ emissions from electric power plants decreasing 36 percent—from 15.9 million to 10.2 million tons—between 1990 and 2004, even though electricity generation from coal-fired power plants *increased* 25 percent over the same period." It was also economically effective, as "the costs of achieving these environmental objectives with cap-and-trade were significantly less than they would have been with a command-and-control regulatory approach. Cost savings were at least 15 percent and perhaps as much as 90 percent, compared with counterfactual policies" that would have reflected more traditional regulatory approaches.[46] Much of these cost savings resulted from the rapidly growing use of low-sulfur coal from the Powder River Basin in Wyoming.

Schmalensee and Stavins explain further that "the majority of coal-fired power plants in the United States are located along or east of the Mississippi River, making PRB [Powder River Basin] the most distant option for major sources of demand. As freight prices fell with deregulation, liberalization gave freight carriers flexibility and incentive to contract with eastern utilities, and these same utilities developed low-cost ways to modify their boilers (which were designed to burn bituminous coal) to burn sub-bituminous PRB coal." Indeed, as power plants and coal companies adjusted to the new legislative and regulatory environment of the 1990s, switching to low-sulfur PRB coal became the single most important method of complying with the Clean Air Act Amendments. Schmalensee and Stavins report that "of the 263 units regulated in the first phase of the allowance-trading program, 52 percent primarily pursued fuel switching [to low-sulfur coal, most of it federal coal] or blending low-sulfur coal with higher-sulfur coal, accounting for 59 percent of emissions reductions; and scrubbers were installed at about 10 percent of the units, accounting for 28 percent of emissions reduction."[47]

While there was some low-sulfur coal in the East, it was the dramatic expansion of federal coal production in the Wyoming part of the Powder River Basin from the 1970s onwards that transformed both the economics of U.S. power plant environmental compliance and the geography of coal production. These developments involved a complex interaction of private economic incentives and close regulatory oversight of air pollution and coal mining at the federal and state levels. Among the close students of all this, there has long been

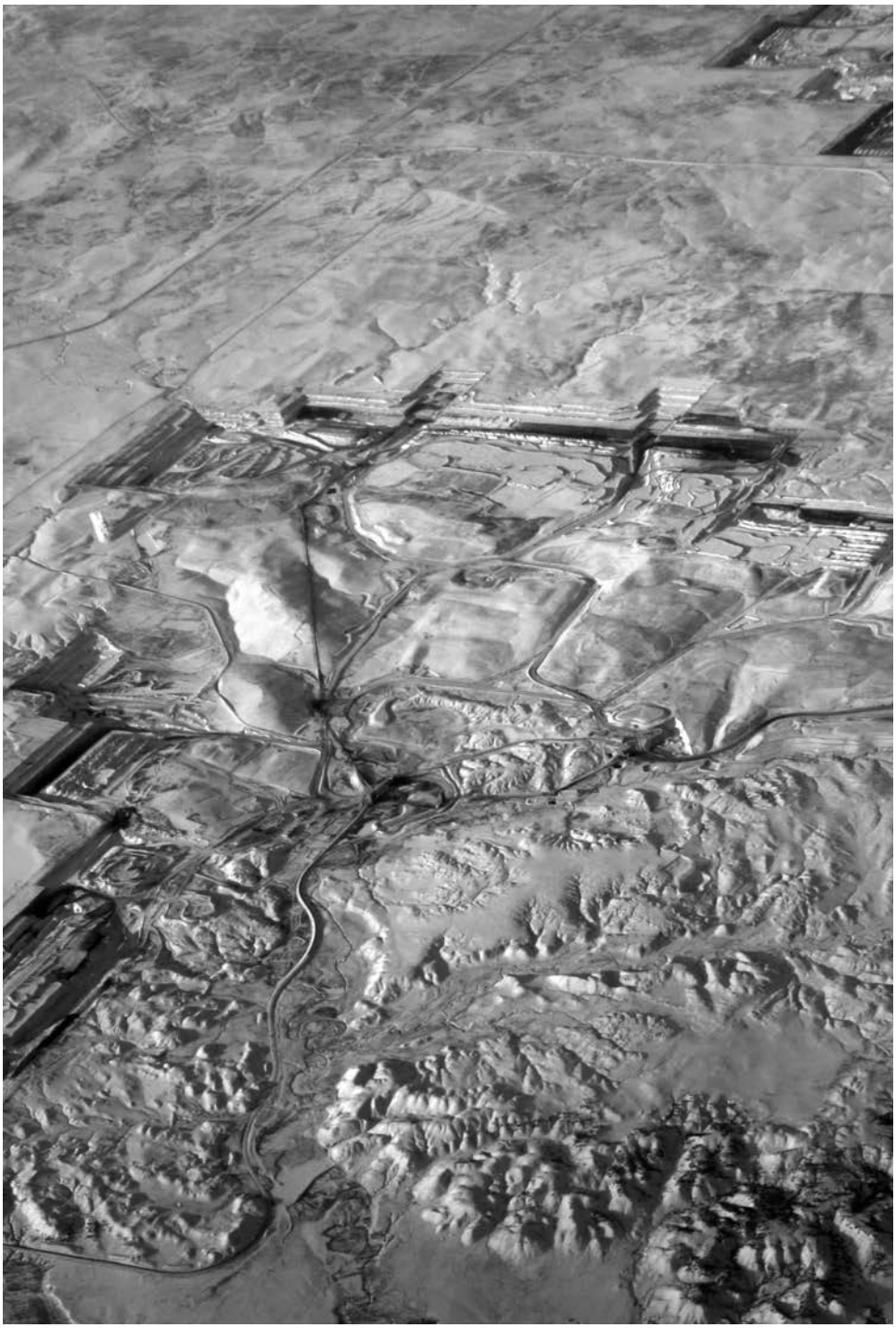
agreement that it served both existing environmental and economic objectives in a particularly effective way for more than two decades.

## CONCLUSION

In recent years, however, another large environmental consideration has entered the picture, casting such past "successes" in a different light. As compared with other fossil fuels, coal emits significantly greater levels of carbon dioxide and thus contributes important shares of total U.S. carbon emissions. In 2014, for example, coal-burning plants emitted 77 percent of the total electric power carbon emissions in the United States. By themselves, electric power plants of all kinds emitted 30 percent of U.S. carbon emissions in 2014. Hence, burning of U.S. coal from federal and nonfederal sources in 2014 resulted in 23 percent of total U.S. carbon emissions, and federal coal alone emitted about 9 percent.

Reflecting a concern for the greater emissions of conventional pollutants from coal burning, federal policy in recent years has increasingly sought to reduce the role of coal in the generation of the nation's electric power supply. The Clean Power Plan (CPP) announced by the Obama administration in August 2015 relies heavily on a strategy of reducing coal power production in order to achieve its 2030 carbon emissions reduction targets. The CPP offers states several options for complying with its EPA requirements for carbon dioxide reductions—one of which is to establish a cap-and-trade system that sets a total limit for carbon dioxide allowances in a given state (or a wider cap-and-trade system with multiple states). This might be described as a demand-side approach, adopting policy measures to reduce total U.S. demand for coal including federal coal.

In the past few years, however, another way of reducing U.S. coal use has been proposed: a supply-side approach that would take direct policy and administrative actions to limit the overall mining of coal in the United States—and thus "keep it in the ground." A leading target for the proponents of such a strategy is the federal coal program. In Part II of this PERC study, I examine this new policy issue that has now come to surround the federal coal program.



Black Thunder Coal Mine North in Wyoming's Powder River Basin. *Photo © flickr.com / Doc Searles*

# PART II: SHOULD WE KEEP IT IN THE GROUND?

The recent environmental movement to curtail the use of fossil fuels by cutting off the sources of their supply—often referred to as the "keep it in the ground" movement—achieved a major success in 2015 when the Obama administration denied a permit for the construction of the Keystone XL pipeline, potentially limiting the development of oil contained in the Alberta tar sands. After this activist success, another leading target has become the one-third of coal reserves in the United States that is owned by the federal government. The most significant of these federal coal reserves are in the Wyoming part of the Powder River Basin, which in recent years have been the source of about 85 percent of total federal coal production and about 35 percent of total U.S. coal production. Because these reserves are federally owned, unleased reserves at present could be permanently kept in the ground simply as a matter of a federal policy decision, however politically controversial it might be. Part I of this study examined the history of the past use and management of federally owned coal, referred to here as "federal coal." Part II examines recent issues relating to the possibility of keeping federal coal—predominantly in the Wyoming Powder River Basin—in the ground.

As compared with the Keystone XL pipeline, the possibility of keeping Wyoming federal coal unmined is complicated by the fact that more than 7 billion tons of Powder River coal (including a limited amount in the Montana part of the Powder River Basin) is under lease

in 2016 and thus already available for future mining. In 2015 the production of federal coal in the Wyoming Powder River Basin was 310.7 million tons, down sharply from 414.8 million tons in 2008. At this most recent rate of production, existing federal coal leases might be capable of sustaining as much as 20 more years of production before all currently leased reserves would be exhausted.[48] And should the recent trend of declining production of Wyoming Powder River coal continue for long, federal coal already under lease might be sufficient to sustain production well past an additional 20 years.

It might be possible, however, to shorten this period, but this would depend on two key factors that are difficult to know. Without using new federal coal leases to replenish some existing coal mines, certain Powder River mines might become uneconomical to operate. Consequently, some of the federal coal already under lease could be left in the ground. Another possibility is that some federal leases might be terminated sooner than expected. Assuming a lease has satisfied or will satisfy the 10-year diligent development requirement, the term of a federal coal lease is 20 years. By longstanding practice, if the mining company so requests, and a mine is still operating, federal coal leases in their 20th year have been renegotiated and renewed. If a lease is part of such a currently producing mine, it is legally uncertain and perhaps doubtful that the Bureau of Land Management (BLM) could act to terminate the lease altogether after the 20-year period by refusing to renegotiate in good faith the terms of a new federal coal lease.

A more likely possibility—but one that still faces some legal uncertainties—would be to increase the federal royalty rate to a level high enough that a Powder River mine using large amounts of federal coal might find it uneconomical to continue to operate. If the federal government were deemed to have deliberately driven a coal mine out of operation in such a way without an adequate legal justification for the much-increased royalty rate (an area of considerable uncertainty at present), it conceivably could be forced to compensate the mine owner for violating the original lease contract terms, or a court might order a royalty reduction.

If currently leased federal reserves are in fact sufficient to sustain Powder River coal production for anything like 20 years or more into the future, the movement to "keep it in the ground" might not have much practical significance today. The main consequence might be to force the mining of marginally less-economic federal coal currently under lease, rather than other superior federal coal deposits that are not now but could have been leased in the future. Largely due to demand-side developments, the use of coal by U.S. electric power plants has been declining rapidly in recent years, from 49 percent of power production in 2006 to 33 percent in 2015. In March 2016, utility coal use fell precipitously to become the source of only 24 percent of U.S. power production.[49]

Such rapid declines in the use of coal for power production in the United States are being driven by environmental and economic pressures beyond concerns over climate change

alone. As a result of the fracking revolution, large volumes of natural gas have increasingly been available at low enough prices that gas can often outcompete coal as a source of fuel for electric power production. Among fossil fuel sources, coal is also significantly disadvantaged by the fact that burning it emits much more sulfur dioxide, nitrogen oxide, and other traditional pollutants than natural gas or renewables, its main competitors. If the EPA's Clean Power Plan, announced in August 2015, survives to go into effect, it will create further environmental and economic pressures to reduce the use of coal. In short, by the time that restrictions on federal coal leasing today might start to have any real effects on the amount of federal coal being mined, there may not be much demand left for federal coal—or any U.S. coal for that matter. Thus, the current policy debate about keeping federal coal in the ground may have mainly symbolic overtones with respect to the future role of fossil fuels in U.S. energy production.

It might nevertheless still be argued that taking actions now to end federal coal leasing should be regarded as an insurance policy against the possibility that coal use once again becomes economically attractive. In the event that current trends of sharply falling coal demand and rapidly declining national use of coal somehow falter, an end to federal coal leasing today could limit the total future use of coal in the United States. Internationally, it might also be regarded as an important symbolic means by which the United States demonstrates to other nations the seriousness of its own determination to reduce the use of coal. Thus, it could encourage other developing nations such as India—where national coal production is expected to increase rapidly—to take stronger steps to limit their own coal use.

These symbolic arguments, however, are not the main ones currently being made by proponents of keeping coal in the ground, and thus it may help to clarify the public discussion to consider the merits of some of the arguments that are being made. The case for halting new federal coal leasing today is in fact similar to the case made in the 1970s by an earlier generation of environmental activists who in those days also sought to keep federal coal in the ground, as discussed in Part I of this PERC study. As the dirtiest and most environmentally intrusive of all forms of fossil fuel production, surface mining of coal—and in particular, federal coal—has long attracted special environmental attention.

## WILD EARTH GUARDIANS

An early indication of things to come was the publication of a 2009 report by Jeremy Nichols, a staff member at Wild Earth Guardians, an environmental organization whose motto is "a force for nature." The report, "UnderMining the Climate: The Powder River Basin of the West, Key to Solving Global Warming," pointed out that because of the lower energy content of Powder River subbituminous coal, it releases more carbon dioxide per unit of energy than the bituminous coal more commonly mined in other parts of the country.

Nichols was most concerned, however, with reducing the absolute amount of coal burned in the United States—to which federal coal in the Powder River Basin is a major contributor. As the owner of this coal, the federal government, Nichols argued, failed to perform its public responsibilities to include climate change in its environmental impact analyses and other decision documents in the management of the federal coal program.

Nichols also argued that this environmental failure had been facilitated by the shift in 1990 to the method of leasing by individual application (discussed in detail in Part I). Since the shift, BLM's environmental analyses were done proposed-lease-tract by proposed-lease-tract; nowhere was the BLM taking into account the potentially large cumulative impacts of federal coal production on carbon emissions. As Nichols argued, this represented a failure of federal coal management. The failure to account for carbon emissions, he wrote:

> is the result of the [1990] "decertification" of the Powder River Basin and reliance on the "Lease by Application" process. Because the BLM is not [any longer] required to adhere to standard leasing procedures [as established in the 1979 federal coal program], the agency has never prepared a regional analysis addressing the global warming impacts of coal leasing in the Powder River Basin. Consequently, the agency has not established regional leasing levels that take into account global warming impacts. Furthermore, the BLM has not delineated, ranked, or scheduled for sale any coal lease based on any consideration of associated carbon dioxide emissions and global warming impacts.[50]

Factually, all of this was true. Indeed, it was similar to the arguments made by coal program critics in the 1970s: that the federal government must not move ahead with leasing more federal coal until a national "need" for it has been demonstrated (see Part I). In the 1970s, it was expected that "need" would be demonstrated in terms of a necessary role for federal coal in meeting the energy requirements of the U.S. economy. In response, the Programmatic Environmental Impact Statement released by the Interior Department in April 1979 attempted—ultimately without much success—to demonstrate that future production of federal coal was in fact needed to meet national energy requirements.

Nichols, however, proposed a new standard of need: the appropriate role of federal coal in reducing total emissions of carbon dioxide—and potentially other greenhouse gases. As he argued, the federal government had failed to demonstrate that reduced releases of carbon from federal coal production were not a necessary element of a viable national program for carbon dioxide management. When he made this argument in 2009, there was no such national carbon program in existence. By 2016, however, the Obama administration was systematically moving on a number of fronts to limit carbon emissions in the United States,

including most prominently the Clean Power Plan announced in 2015. The January 2016 announcement of a moratorium on new federal coal leasing during the period while a new federal coal programmatic environmental impact statement was being prepared, might be seen as the Interior Department agreeing with the basic validity of Nichol's original argument from 2009.

As in 1979 with respect to the proper role of federal coal in meeting national energy needs, however, it remains an open question how much the Interior Department can say now about its proper role in U.S. national management of carbon emissions. Although the United States is taking many piecemeal actions to reduce carbon emission, there is in fact no national carbon emissions policy or management plan. Given that the use of carbon dioxide is interwoven throughout the American economy, any national plan for allowable carbon emissions would have to be derived from some form of comprehensive national economic planning, which also does not exist. The Interior Department, to say the least, is an unlikely candidate for the writing of such a national plan as part of its forthcoming Programmatic Environmental Impact Statement for the federal coal program, as announced in March 2016. Among the issues it will consider, this Programmatic EIS will examine the question of whether new policies should be adopted to keep federal coal in the ground. As discussed in Part I, the writers of the 1979 Programmatic EIS for Interior coal management wrestled with a similar problem: how to prescribe in considerable detail the appropriate role of federal coal in meeting the national energy needs of the American economy, when no comprehensive national energy plan existed. The inability to resolve this problem contributed to the fictional quality of the numbers provided in the 1979 document and the economic analysis of the "need" for federal coal—and consequent need for new federal coal leasing—provided by the Interior Department.[51]

Faced with similar issues, in 1984 the Linowes Commission argued that the Interior Department had been asking the wrong question. The issue of the "need" for federal coal and new federal leasing did not have to be answered; beyond a certain fairly low level of federal reserves under lease (relative to the total amount of federal coal), additional amounts of federal coal leased would not have much impact on the total amount of federal coal produced. This is because, given the large coal reserves in the Wyoming Powder River Basin, there is far more federal coal potentially available for mining than there will be demand for in the foreseeable future. In other words, if the federal government leases enough federal coal to generously meet current demands from electric power plants (at current prices) for Powder River coal—and the amounts of federal coal already under lease today in 2016 are probably sufficient for this purpose (assuming no major increases in exports in the future)—leasing more coal will not mean more coal production; rather, it will mean that larger amounts of leased coal will never enter into production.

Any resulting decline in the price of Powder River federal coal due to more leasing is not likely to be large enough to increase current total utility demands for this coal. Assuming that is the case, there will be few federal coal leasing impacts on U.S. energy supplies (and carbon impacts). Unless the federal coal supply is very tightly restricted (insufficient to continue existing mining operations), the actual production of federal coal will be primarily demand-driven. If federal coal supplies were to be very tightly restricted, an unfortunate consequence would be the creation of an anti-competitive situation in which those limited coal companies fortunate enough to continue operating would be able to charge their utility customers anti-competitive prices. In that case, a new policy of expanded federal coal leasing might increase competition among coal companies for power plant contracts and thus lower federal coal prices. The resulting increased utility demand for federal coal might then result in significant increases in federal coal production in the Wyoming Powder River Basin and elsewhere.

While it has not been part of past coal program policy discussions, if the Interior Department did decide to very tightly restrict federal coal availability (such that less federal coal was available than is needed to meet even current federal coal demand at current coal prices), the economically best means of implementation would be to adopt a rationing system for federal coal production rights. A producing coal company would then not only need to hold the rights to leased federal coal but also a permit to produce federal coal at all (and fewer such rights would be available than the amount of leased federal coal). In this way, instead of some fortunate coal companies earning monopoly profits from tight federal supply restrictions, the monopoly profits resulting from a tightly enforced scarcity of federal coal would be captured by the government itself through the sale of the rationed production rights. With a cap on federal coal production, it would resemble in some ways the cap-and-trade systems thus far established under the Clean Air Act.

## AN ENVIRONMENTAL JOHN THE BAPTIST

Recalling Bruce Yandle's helpful analogy of the bootleggers and the Baptists, a new set of Baptists has recently emerged to become an important force in the federal coal program. These new Baptists are still found within the environmental movement, but today they have a new cause. Environmentalists of the 1970s were concerned with protecting the supposedly "pristine" environment of the rural West, which had not previously been desecrated by what they considered to be unnatural coal mining. The environmental Baptists of today are again concerned with keeping the natural world in as pristine a condition as possible, but their focus is now the global climate.

The bootleggers in our current circumstances are less easily identifiable than the eastern union and coal company mining interests in the 1970s who sought—along with their environmental allies—to block federal coal development in the West. The closest equivalents

today are the natural gas industry and the wind, solar, and other renewable energy producers that would stand to benefit from a declining role for coal in the U.S. energy system. Indeed, the Sierra Club would like people to forget that from 2007 until 2010 it accepted many millions of dollars from a major gas producer, the Chesapeake Energy Corporation, to run a "dirty coal" campaign with the aim to shut down as many coal-burning power plants as possible.[52] The crusade against coal still continues at the Sierra Club (without the Chesapeake money), but it has now turned against all fossil fuels, including natural gas (at least when it is obtained by fracking).

The leading contemporary environmental ally in this effort is Bill McKibben, who was a central figure in the campaign to block the Keystone XL pipeline. McKibben combines a crusading environmental zeal with an engaging candor about what it will take in American society for environmental values to have a greater impact in practice. In 2012 he wrote a revealing article for *Rolling Stone* on "Global Warming's Terrifying New Math," in which he described a set of actions that would be required to hold the increase in world temperatures to the widely accepted goal of no more than 2° C by 2100. As McKibben wrote, "scientists estimate that humans can pour roughly 565 more gigatons of carbon dioxide into the atmosphere by midcentury and still have some reasonable hope of staying below two degrees." That was in effect the amount of room left for humans to spend in their "global 'carbon budget.'" According to McKibben, the world is headed toward a disastrous outcome, however, because at current rates of carbon emissions the global budget would be completely exhausted in 16 years, leaving the earth in climate change bankruptcy and on a trend line "perfectly in line with a temperature increase of six degrees" Celsius, or 11 degrees Fahrenheit.[53]

Facing such a dire emergency, McKibben called for drastic measures, including a new strategy for holding down carbon emissions. He argued that it was possible to calculate "the amount of carbon already contained in the proven coal and oil and gas reserves of the fossil-fuel companies, and the countries (think Venezuela or Kuwait) that act like fossil-fuel companies." This number, according to McKibben, is 2,795 gigatons—five times higher than the global carbon budget of 565 gigatons. As McKibben proposes, climate policy must shift to a new strategy of preventing the development of 80 percent of the current fossil fuel reserves already owned and intended for production by various companies, nations, and other institutions around the world. In other words, this 80 percent of reserves needs to be kept in the ground.

One possibility discussed by McKibben is federal coal. He writes that during the Obama administration the "secretary of interior… opened up a high swath of the Powder River Basin in Wyoming for coal extraction. The total basin contains 67.5 gigatons worth of carbon (or more than 10 percent of the available atmospheric space.)" McKibben condemned the actions of President Obama who, following a policy of "'Drill, baby, drill,' had gone out of his way to frack and mine" in places such as the Powder River Basin. For McKibben, the

fact that a rich nation such as the United States was using up so much of the future world capacity to absorb carbon emissions made it morally reprehensible.

McKibben did not trust economists or other policy analysts to provide him with the intellectual support and other ammunition by which a climate policy revolution of such a large magnitude might be accomplished. More primal methods that reach deeper levels of public emotion would be necessary. McKibben was surprisingly frank about all this. As he wrote, "a rapid, transformative change would require building a movement, and movements require enemies. And enemies are what climate change has lacked." The obvious leading candidate was the fossil fuel industry. McKibben thus explained that "given this hard math" of the global carbon budget, "we need to view the fossil fuel industry in a new light. It is Public Enemy Number One to the survival of our planetary civilization."

By hammering this theme home at every opportunity, McKibben hoped to spark a moral and climate policy revolution. He acknowledged that "pure self-interest won't spark a transformative challenge to fossil fuel. But moral outrage just might—and that's the real meaning of this new math. It could, plausibly, give rise to a new movement." The new math, in other words, is not really about a technical or scientific set of calculations. It is a rhetorical tool for spreading the climate word in a new and hopefully more powerful way.

## THE GREAT GIVEAWAY

McKibben's thinking would soon assume a new importance in climate policy discussions. McKibben himself drew from and refined this formula in leading the successful fight to block the Keystone XL pipeline. The federal coal program has now become a new battleground. Since 2012, a series of publications have portrayed the coal program as a large "subsidy" to Powder River coal companies at the expense of ordinary American taxpayers.[54] In January 2016, environmental activists successfully pressured the Interior Department to declare a moratorium on new federal coal leasing for three years while a new programmatic environmental impact statement for the federal coal program is prepared. This EIS is intended to examine all aspects of the coal program, including a much-increased level of attention to climate impacts.

A 2012 report by the Institute for Energy Economics and Financial Analysis, titled *The Great Giveaway*, would set the stage for other critical studies of the federal coal program. In particular, the report criticized the process by which the federal government appraises its coal reserves, which in turn affects the amount of coal being leased and potentially future coal production. The report found that "although the appraisal process—which is governed by federal statute, regulation, and the internal BLM handbook—outlines vigorous standards, there is no publicly available evidence that the BLM has followed these standards." Indeed, the coal appraisal failings were so great that they had resulted in an estimated "loss

of revenue in the range of $27.6 to $28.9 billion for the federal government and its partner states since 1983."[55] This included estimated cash losses of $7.1 billion in lower bonus bids received in competitive coal lease sales due to flawed appraisal procedures, which set minimum acceptable bids that were too low for certain new coal leases. The largest federal coal "giveaway" of about $21 billion, however, was said to be due to a failure to collect the full royalty payments that the coal leases were capable of generating.

To calculate these unrealized federal coal royalties, the report relied on an unprecedented and economically confused concept of a fair "market value price." This price was not the actual coal price charged by coal companies to power plant purchasers—the longstanding basis for calculating royalty payments—but a much higher price that the report asserted actually represented the "fair" value of the federal coal, which should have instead been used to calculate royalty payments. Since it was not directly observable in the marketplace, this "fair" price had to be estimated—it was a "market proxy," as the report explained. Calculating projected hypothetical royalty payments based on this new higher price and comparing them with the actual much lower BLM royalty collections, the report concluded that the failure to base royalties on the "fair market price" (rather than the actual sale price of the coal in the market), had cost taxpayers many billions of dollars.[56] This idea had never been seriously discussed in the long history of the federal coal program—and for good reason. The report's author seemingly was not aware that he was advancing a royalty methodology according to which the federal government should exploit more fully its monopoly position in the Wyoming Powder River Basin in the pursuit of maximum royalties, a problem that is discussed in detail further below.

The report was also critical of the BLM's coal lease appraisals for not giving enough attention to the expected high export potential of Powder River coal. The study suggested that exports might reach 500 million tons per year, a wildly high estimate in retrospect, equal to about 50 percent of U.S. coal production in 2012. A leading recommendation of the report was that the Interior Department should declare a moratorium on federal coal leasing in the Powder River Basin—as would happen four years later—to allow more time to take account of "the demand for new PRB [Powder River Basin] lease applications and coal reserves [that] is driven by coal producers responding to international supply and demand price signals in global markets, not to meet the need of the nation for electricity."[57] Estimates of fair market value would have to correspondingly increase to reflect the great export potential thus far left out of Interior Department appraisal calculations.

Despite its large conceptual and other major deficiencies, the publication of *The Great Giveaway* attracted favorable public notice during a period of rapidly growing skepticism about the management of federal coal. Its 62 pages filled with technical-sounding language seemed to provide an objective confirmation of the McKibben indictment of the federal

coal program issued later that summer. The estimate of a $28 billion shortfall in federal coal program revenues since 1983 would be picked up and repeated in other coal program commentary in subsequent years.[58]

Another recommendation in *The Great Giveaway* was that the Inspector General of the Interior Department should investigate the federal coal program. Illustrating the seriousness with which the report was taken, in 2013 the Interior Inspector General (IG) released a report on the program. It found that four coal companies—Alpha Natural Resources, Arch Coal Corporation, Cloud Peak Energy Corporation, and Peabody Energy Corporation, all operating in the Powder River Basin—were the sources of more than 90 percent of total federal coal production. The IG report argued that the managers of the federal coal program were obtaining much less revenue than the coal was worth.[59] This was said to be due to a failure to generate bidding competition in federal coal leasing, the deficiencies of the federal coal lease appraisal process, and related problems such as the failure to take the large export potential of Powder River coal into account.

*The Great Giveaway* also called for an investigation by the Government Accountability Office. Almost on cue, then U.S. Rep. Edward Markey of Massachusetts requested a GAO report that would be published in December 2013: *Coal Leasing: BLM Should Enhance Appraisal Process, More Explicitly Consider Coal Exports, and Provide More Public Information.* Like the Interior IG report, GAO was concerned about the lack of bidding competition; indeed, it noted that the last time a stand-alone federal coal tract (one that is capable by itself of supporting a new mine) was offered for lease—and thus had much chance of generating bidding competition from multiple coal companies—had been in 1982. The GAO's leading criticism of the BLM appraisals again was that the agency "considers exports to a limited extent when estimating fair market value. As a result, BLM may not be factoring specific export information into appraisals or may not be fully considering the export potential of a lease tract's coal as called for in agency guidance."[60]

The Interior IG and GAO expectations for Powder River coal exports were overstated, and estimates of likely exports have fallen precipitously since the reports were issued. When a mistaken future prediction such as an expected large role of federal coal exports becomes a little-examined statement of conventional wisdom, it is easy for the mistake to cascade, especially when it conforms to popular moods of the moment. In a 2015 *New Yorker* article on "The Obama Administration's Self-Sabotaging Coal Leases," Elizabeth Kolbert wrote: "so where's the coal from the new Powder Basin leases supposed to go? If the [coal] industry has its way, it will go to other countries." She quoted Bill McKibben approvingly to the effect that Obama administration leaders were content to "make long speeches about the immorality of passing on a ruined world to our children… [But] they just deny the meaning of the science, which is that we must keep carbon in the ground."[61]

The recent reports on the federal coal management program typically maintain a professional air of rational objectivity. The reality, however, is that they are usually based on doubtful assumptions, are analytically flawed, or otherwise have significant failings. These reports nevertheless often do well in the forum of public opinion because, as McKibben recommended, they examine the federal coal program in moral terms of good versus evil. Morality, not for the first time, is being disguised in federal coal policy making in the language of professional economic and environmental science. Even supposedly authoritative government bodies such as the Interior IG and the GAO added their weight to the new federal coal program crusade, partly because others later exaggerated their more cautiously worded criticisms.

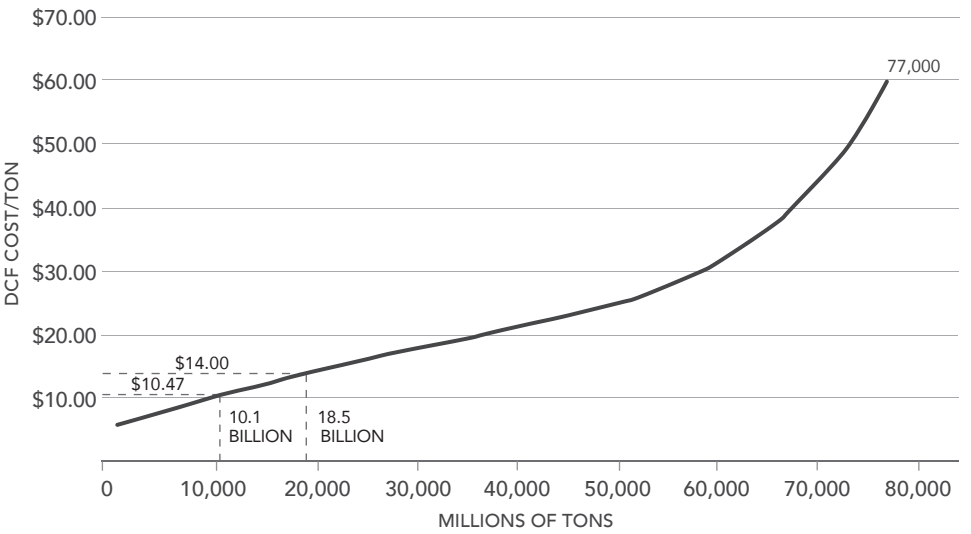
## THE MONOPOLY TEMPTATION

A consistent problem in almost all recent federal coal program reports is a failure to take adequate account of the complications posed by the fact that the federal government dominates coal ownership in the Wyoming Powder River Basin, giving the government in essence a large degree of monopoly power. There is non-federal coal in the Wyoming Powder River Basin—perhaps about 15 percent of the total, including much of it that is state owned (the exact number is not easily obtained). But the presence of this small amount of non-federal coal does little to limit the anti-competitive powers of the federal government. There is likely no coal tract in the Wyoming Powder River Basin large enough to form a new mine that could be assembled strictly from private and state coal sources. Many existing coal mines have around 85 to 90 percent federal coal, with private and state coal intermingled to form the rest of the mine (making up what is referred to as the "logical mining unit" for federal regulatory purposes). In this way, federal coal leasing policy essentially determines the total amount of coal coming out of the Powder River Basin. The federal government thus could in principle set any royalty it wanted without being undermined by private or state competition. The real constraint on seeking to maximize federal royalty collections is that, like any other monopolist, the federal government could overshoot the net revenue-maximizing royalty.

In considering the problem of potential monopoly pricing of federal coal in the Powder River Basin, it may help to consider the following hypothetical set of circumstances. Assume that all of the coal in the Wyoming Powder River Basin has the same production and transportation costs. Assume also that there are a large number of small individual owners of this coal, so that real market competition among coal owners exists. If that were the case, the competitive market value of the Powder River coal would be zero—there would be far greater coal resources than needed to meet any Powder River coal production demands, and no coal deposit would be worth any more than any other coal deposit. If real competition existed, the price of coal tracts would be driven to zero. (If a coal owner tried to charge a

FIGURE 3

**Cost Curve Estimates by Price Per Ton for Coal in the Wyoming Powder River Basin**




SOURCE: J.A. Luppens, D.C, Scott, J.E. Haacke, L.M. Osmonson, T.J. Rohrbacker, and M.S. Ellis, *Assessment of Coal Geology, Resources, and Reserves in the Gillette Coalfield*, Powder River Basin, Wyoming, U. S. Geological Survey, Open File Report 2008-1202 (2008).

positive price, some competitor without any contract would undercut it.) Zero would in fact be the "fair market value" of Powder River coal. It would require some element of monopoly pricing to drive the value above zero.

This is obviously a large simplification, but the equal cost assumption is not so far from the reality of the Powder River Basin in Wyoming, where there is a staggering amount of coal—far more than is required to meet current demands—that can be produced at similarly low costs. Indeed, as shown in Figure 3, according to 2008 estimates by the U.S. Geological Survey, there were about 10 billion tons of coal available for production in the Wyoming Powder River Basin at $10 per ton or less, about 18 billion tons for $14 per ton or less, and about 35 billion tons for $20 per ton or less—amounts that vastly exceed the region's peak historical production of around 450 million tons per year. Supplying current Powder River coal demands at production costs of $10 per ton or less thus could be sustainable for at least a decade or two and at $14 per ton for several more decades if the federal coal were actually made available for production. Given the fact that the federal government owns most Powder River coal, setting the quantities of Powder River coal made available—and the resulting equilibrium market prices of this coal—becomes a matter of federal policy.

Given the royalty rates of 12.5 percent for surface mined federal coal (and 8 percent for underground coal, which is a limited part of total federal production), current federal coal royalty collections are about $680 million per year. This implies total annual current sales of federal coal for royalty purposes of more than $5.5 billion. For federal coal production of about 400 million tons per year, this implies royalties of around $14 per ton. Examining the Powder River coal supply curves, this suggests that coal prices may typically be no more than a few dollars above the marginal costs of Powder River coal production (which do not factor in transportation and other non-production costs).

Economic theories of regulation and resource management commonly seek to address the problems posed by monopoly circumstances in the American economy. But no well accepted economic theory suggests that the federal government should act to exploit a government monopoly position to maximize government revenues. Hence, the federal government necessarily must impose significant self-restraint in its pursuit of higher financial returns from the sale of its federal coal leases in monopoly circumstances such as the Powder River Basin. How to define an appropriate level of federal "self-restraint," however, is outside the scope of standard appraisal theory. In the case of a private monopoly such as an electricity distribution network, state utility regulators do not rely on appraisal methods but instead turn to the concept of a "fair price," which is essentially based on production costs plus a reasonable rate of return.

Federal coal, however, as a nonrenewable natural resource, has no production costs in and of itself; it is in essence free to the federal government as a matter of the initial possession of the "God-given" land and underlying coal resource. It is thus even possible to argue that in concept all federal coal should simply be made available for minimum prices—that the true competitive market value price, as suggested above, may be not much more than zero, and that most positive value in federal coal comes from the human efforts of a coal company and a power plant user of the coal, rather than from any intrinsic economic value of the federal coal resource. Stated another way, if a federal coal lease in the Powder River Basin brings in a significant sale price, it might be seen as prima facie evidence that the federal government—however unknowingly or unintentionally—is restricting federal coal supply in order to capture monopolistic revenue gains.

The Linowes Commission in 1984 addressed the issue of federal monopoly power in places such as the Wyoming Powder River Basin.[62] The potential for anti-competitive prices for federal coal leases due to restricted coal supplies had increased due to a moratorium on almost all new federal coal leasing that lasted from 1971 to 1981. The Commission recognized, however, that the continuing availability of very large amounts of federal coal leased in the 1960s, held by many competing individual lease owners, and the possible further amounts from conversion of preference right applications into new coal leases, had

worked well to contain any anti-competitive risk of monopolistic federal coal pricing. As the Commission wrote:

> Given the large amounts of Federal coal already under lease, and the production capacity already available, the Commission found no evidence that existing levels of Federal coal leasing are employing federal market power to drive coal prices artificially upward in a monopolistic fashion. On the other hand, the Committee could also not preclude this possibility in the future. The Government must remain alert to avoid any monopolistic behavior in its leasing policies.[63]

This concern for possible future federal monopolistic practices was not unwarranted. Even some high-level federal agencies today are raising as realistic possibilities what would be in essence monopolistic federal coal leasing and pricing strategies. In a 2016 report, the U.S. Council of Economic Advisers, for example, included two alternative approaches to earning "fair" government revenues from federal coal, both of which would involve some significant element of exploitation of federal monopoly powers in the Powder River Basin. One was an "approach that establishes royalty payments based on the objective of maximizing government revenues"—thereby potentially increasing total federal coal revenues by as much as $3 billion per year, according to the CEA.[64] The federal government could indeed try to maximize its revenues by setting a monopolistic royalty for federal coal in the Powder River Basin. It is likely, however, that any attempt to bring in $3 billion per year in increased federal coal royalty payments would significantly overshoot even a monopolist's revenue-maximizing strategy (monopoly pricing is not unconstrained). Above a certain price, as economic theory tells us, further price increases by a monopolist will result in large enough declines in demand that total revenues will fall as a result.

Given that total federal coal royalties in 2015 were about $680 million, royalty collections would have to increase by more than a factor of 4 to achieve a $3 billion revenue target (effectively requiring an increase in the royalty rate from the current 12.5 percent to more than 50 percent of current coal production sale value). Such an exercise in monopoly power would in practice likely amount to a severe federal limitation on the future use of Wyoming Powder River federal coal—one way to ensure that it is "kept in the ground," even as federal revenues would fall well short of $3 billion per year.

This may be a desirable result, at least for those who believe that U.S. federal coal production should end as soon as possible. But it would be more honest to say so directly, or by conducting a credible calculation of coal's environmental costs relative to its economic values, rather than disguising an objective to stop federal coal development in the name of achieving a fair economic return in federal coal royalty policy.

## SEVERANCE TAXES VERSUS ROYALTIES

When a mineral such as coal is to be used as a source of government revenue, it has traditionally been done through what has been called a "severance tax." Many states, for example, impose severance taxes on mineral developers operating within the state. The expectation is that a severance tax will be uniformly imposed on the owners of the mineral rights, not on one set of owners. The Wyoming coal severance tax of 7 percent, for example, applies to federal and non-federal coal alike. A severance tax has the revenue-raising advantage that, like other forms of taxation, the government can change the severance tax rate at any time as may be appropriate.

A "royalty," however, is by longstanding practice something much different. In the private sector, a royalty is in essence one term in a contract written between a buyer and a seller of a mineral right. Royalties are specific to each contract and can vary significantly among different buyers and sellers of the same mineral rights even in close proximity to one another. In federal coal leasing, the government does impose a uniform royalty on all federal (surface mined) coal. But unlike a severance tax, a royalty generally cannot be changed until the contract governing it expires.

If the royalty was to be used as a general federal revenue-raising device, one problem is that there would be widely varying royalties paid by the owners of different federal coal leases according to the terms of the original lease contracts, creating efficiency and equity problems. Rather than seeking a "fair" level of federal revenues, federal coal royalty levels have historically been evaluated as to whether they correspond to market royalties observed in other current willing buyer and willing seller coal right contracts. The standard of comparison ideally should be other private and public coal contracts—although this is hard to do in the Wyoming Powder River Basin, where there are few non-federal coal reserves. Those who now propose that the purpose of federal royalties is to earn high revenues for the federal government may not realize it, but they are proposing a radical departure in this regard.

One major difference between severance taxes and a federal coal royalty is the fact that about half of the federal revenues from coal royalties (as well as other mineral lease revenue sources) are distributed to the state where the coal is mined. This is the result of longstanding provisions of the Mineral Leasing Act. Half of any new money collected from federal royalties in the Wyoming Powder River Basin thus would go not to the federal government but to the State of Wyoming. This fact inhibits the ability of the federal government to use federal coal royalties for its own revenue-raising purposes. It might also be questionable in terms of the distributional consequences among western states.

Wyoming is already a large beneficiary from federal royalties and other mineral leasing revenues it receives. Total federal mineral revenues (including oil and gas) in Wyoming in 2013 were $2 billion, much more than any other state, resulting in federal payments to the

state of $932.5 million.[65] More than half of this came from federal coal. Wyoming received $250 million from coal royalties and $238 million from the payments by high bidders in coal lease sales—traditionally called "bonus bids."[66] Other western states such as Idaho and Oregon, however, have few federal minerals and receive far smaller payments. They might well regard it as unfair for Wyoming (which has traditionally funded much of its state budget from minerals sources) to receive significant additional coal revenues as a result of a new federal strategy to maximize its royalty collections for general federal revenue purposes.

## THE SOCIAL COST OF FEDERAL COAL

Several economists have recently proposed that new federal coal leases (or coal leases renewed once their 20-year terms expire) should account for the social cost of carbon as part of federal coal royalties.[67] Imposing a carbon tax on federal coal production would have a different justification from severance taxes or other traditional coal taxes—the former is designed to correct for the external costs of carbon emissions from coal burning, while the latter have been intended to raise federal and state government revenues. According to recent federal calculations, the social cost of a ton of carbon emissions in 2020 will be $46. For coal, this would convert into a social cost of $94 per ton of coal burned.[68] For reference, if a carbon tax (or royalty rate) were applied to federal coal production in an amount equal to the estimated social cost of carbon, the tax would be more than 50 times the current average federal coal royalty of around $1.70 per ton of Powder River coal burned. At that level, it would very likely mean the end of federal coal production in the Powder River Basin as soon as the far higher royalty took effect.[69]

This possibility of abolishing new federal coal leasing—whether by simply establishing a permanent ban on new federal coal development or by imposing a full carbon tax—raises some major questions for policymakers. One of particular importance is how much confidence we should place in current estimates of the social cost of carbon. Although the federal government has a working group to provide an official number for the social cost of carbon for the purpose of benefit-and-cost analyses and other internal calculations, there are large uncertainties relating to the official government numbers. As recently as 2010, the accepted federal social cost of carbon for 2020 was $26.30 per ton; after just six years, the figure increased 77 percent. Estimates of the social cost of carbon depend critically on the discount rate used. In the 2010 calculations, a discount rate of 5 percent yielded an estimate of $6.80, as compared with a 3 percent discount rate that yielded the $26.30 number that was officially adopted.[70]

In a 2013 article in the *Journal of Economic Literature*, Harvard economist Martin Weitzman wrote that "when exponential discounting is extended over very long time periods, there is a notoriously hypersensitive dependence of cost-benefit analysis (CBA) on the choice

of a discount rate." What might seem to be "insignificant differences in discount rates can make an enormous difference in the present discounted value of distant-future payoffs." Indeed, the disconcerting reality is that "in a very long-run situation like climate change, it may not be too much of an exaggeration to say that almost any answer to a CBA question can be defended by one particular choice or another of a discount rate." It is not only the discount rate, moreover, because different methods of calculating the social coal of carbon can also yield results that vary greatly. Illustrating this point, Weitzman found that under plausibly defensible assumptions the method he preferred could yield results ranging from as low as $1 to $266 per ton.[71] Imposing a royalty equal to some asserted social cost of carbon—however arbitrary—may thus be a disguised way for federal policymakers favoring a total ban on federal coal production to achieve their policy objectives without saying so.

Integrated assessment models (IAMs), the large computer models that are used to simulate national and world energy and climate systems under varying assumptions, play an important role in estimating the social cost of carbon. The reliability of these models, however, is also subject to basic questioning. MIT economist Robert Pindyck recently wrote that IAMs "have been constructed and used to estimate the social cost of carbon (SCC) and evaluate alternative [climate] abatement policies. These models have crucial flaws that make them close to useless as tools for policy analysis." He concludes that IAMs are "of little or no value for evaluating alternative climate change policies and estimating the SCC. On the contrary, an IAM-based analysis suggests a level of knowledge and precision that is nonexistent." Much as Weitzman found with respect to discount rates, with respect to the social cost of carbon and other carbon impacts, Pindyck considers that the choice of model specifications can "obtain almost any desired result because key inputs can be chosen arbitrarily."[72] In an area that arouses such intense emotions as climate change, that is not a comforting thought.

If a carbon tax were limited to federal coal, the losers would be concentrated among Powder River Basin coal mine workers and coal companies and those power plants now burning federal coal and their customers, while the climate winners would be spread across the United States and indeed the world. Alan Krupnick and his colleagues at Resources for the Future thus write that "a limitation of a charge only on federal coal is that tribal, state, and privately owned coal resources… would… be excluded from the policy… This would be very likely to result in unintended and/or perverse consequences." They conclude that "its limitation to federal coal provides insufficient coverage to make the policy work as intended."[73]

A 2016 analysis by the consulting firm ICF estimated that an added charge on federal coal equal to the full social cost of carbon, relative to a reference case of the current federal coal program regime, would reduce coal production in the Powder River Basin in 2020 by 78 percent. The same carbon tax would lead to the production of an additional 31 million tons of non-federal coal in 2020 in Appalachia. In the East outside Appalachia, there would

be additional non-federal coal production of 18 million tons in 2020 in the Illinois Basin. So the total non-federal production in these two regions would increase by 49 million tons (about a 12 percent increase).[74] The local environmental costs of coal surface mining almost certainly would be greater in Appalachia than in the Powder River Basin. Appalachian non-federal coal, moreover, would typically involve much higher economic costs of production than the federal coal in the Powder River Basin that would be displaced.

If Powder River federal coal production fell by 78 percent, it would result in the large-scale transitional substitution of new natural-gas burning power plants for older coal-burning power plants. Even if renewables grow rapidly in the next few decades, it will be more difficult to shut down newer gas-fired power plants then, as compared with much older coal-burning plants today. There will also have to be large increases in the amount of fracking in the United States to supply much-increased natural gas demands. Substituting fracked gas supplies for mined federal coal will create a complex set of environmental tradeoffs. Owing to the much lower conventional pollution impacts of gas, for example, there may be significant air-quality benefits. But at least some people in the areas of fracking believe that it imposes large social costs on nearby populations (even as owners of natural gas rights benefit handsomely).

A further large problem with including the social cost of carbon in the federal coal royalty rate is that the official U.S. government calculations estimate this social cost on a global basis—in other words, by estimating the social losses experienced throughout the world from an increased ton of carbon emitted in the United States. A limited amount of the present estimated total social cost of carbon of $46, however, represents social costs incurred in the United States. If the social cost of carbon is included in the federal coal royalty, it would therefore not only be addressing a U.S. external cost but a global one as well. In that case, actions would then be taken within the United States to reduce federal coal consumption with a marginal cost of carbon reduction of $46 or less per ton. Americans would in effect be spending up to $46 to realize internal U.S benefits of probably $10 or less. It is fair to say that few if any past U.S. government decisions based on benefit-cost calculations would have favored taking such an action with such a large negative outcome for the United States itself. Indeed, almost all past U.S. benefit-cost calculations have confined themselves to comparing only domestic costs and benefits.

There are nevertheless two arguments that might be made to justify using the $46 global social cost in U.S. calculations (assuming this figure is even close to an accurate number). First, the United States can be said to cause this much damage globally when it emits a ton of carbon. One might thus suggest that the United States should hold itself responsible for limiting the damage it inflicts on other countries (as well as itself) around the world—a voluntary choice based on essentially ethical grounds. Second, climate change is a global

problem; eventually, if world efforts are to be successful, all nations will have to work together. The United States, it can be argued, should lead the way today by making its internal decisions in terms of global social costs of carbon, recognizing that some nation has to act first, and then other nations will presumably follow. Both of these arguments, however, rely on strategic political, ethical, and other "non-scientific" judgments that are seldom explicitly made or justified by carbon-tax advocates. Krupnick and his colleagues comment that in their view a social cost of carbon "should be a global value, not just the value of estimated damages *inflicted on the United States.*" But they acknowledge that this is "a marked, but inescapable, departure from more conventional, nationally circumscribed cost–benefit calculations" because it places long-run global welfare above national welfare.[75]

## COAL VALUE IS A RENT, NOT A MARKET PRICE

As noted above, one can make an argument that the fair market value of Wyoming Powder River coal is actually closer to zero than to any much higher figure—and that current pressures for much larger federal revenues implicitly seek to benefit from a federal monopolistic position. In considering this issue, it will be helpful to return to the hypothetical simplified model described above. But we can now relax the assumption that all coal in the Wyoming Powder River Basin has the same sulfur content and costs of production and transportation. In this case, coal deposits are no longer a homogeneous resource with zero market value; rather, some deposits would in fact be worth more than others, even if there were significant competition among a large number of coal owners. A competitive market value will arise where some individual coal deposits have superior geologic, transportation, sulfur, or other advantages, as compared with other deposits. In that case, they would each be capable in principle of capturing a higher or lower "rent" (in the language of economics) to reflect their superior or inferior qualities as compared with other Powder River coal deposits.

When the German economist Johann Von Thunen published his famous theory of urban land rents in the mid-19th century, he explained why land rent determination—each location having its own specific rent—worked differently from normal market competition that yielded a common market price.[76] Indeed, where geography plays a large role, its incorporation into microeconomics has significant consequences. Coal rents, moreover, are like Von Thunen's gradient of urban land rents; there is no one fair market price for Powder River Basin coal. Each deposit has its own rent value. It is possible to estimate Powder River coal rents by comparing relative production and transportation costs of each coal deposit. The difference in rental value between any two Powder River coal deposits will be attributable to the difference in the value of their coal quality—mainly due to sulfur levels—and the difference in their transportation and production costs.

To calculate this will require, however, that the government accurately understands the impacts of such matters as relative coal quality, coal seam thickness, levels of overburden, locational transportation advantages, and other features that make one Powder River coal deposit worth more than another. In determining "equilibrium" coal rents, there will be a rank ordering of deposits that will begin with the highest-quality and highest-rent deposits, and then proceed to lower-quality deposits with lower rents. Each level of rent will serve to equalize the profitability of one Powder River coal deposit versus another.

In urban land markets today, appraisals of land rents (values) are commonly determined by the method of comparable sales. This works well because there are large numbers of land sellers and buyers, thus creating active land market competition. In the case of the Powder River Basin, however, as has been discussed, the great majority of the coal is owned by the federal government. Available comparable sales are likely to be few, and many of them will involve existing federal leases being sold from one private holder to another. These may not be good indicators of "fair market value" for two reasons. First, if the federal government already has been unduly restricting federal coal leases and anti-competitively inflating lease values, no available past lease sale price will correspond to a competitively determined market value. If past sales of existing federal leases are used as comparable sales, therefore, the determination of "fair market value" can become a cascading process; one inflated federal appraisal largely determines the next inflated federal appraisal, which determines the appraisal after that. Effectively, fair market value appraisals may take on a somewhat random character, depending on the personal thoughts and preferences of BLM appraisers.

An equally great problem is that a large portion of newly offered federal coal leases will almost inevitably be adjacent to an existing mine (which normally includes one or more previously purchased federal leases). There is therefore likely to be only one coal company reasonably placed to bid on most federal coal tracts offered for lease sale. Lacking bidding competition, it is difficult to say whether any observed lease sale price is a fair market value (rent). Indeed, when a federal lease offering receives only one bid, and especially when the bidder knows in advance that this is likely to be the case, the concept of a well-defined market value loses its meaning. A better description is a negotiated sale that could fall anywhere within a potentially wide range of values that would each meet the requirement of a willing seller and a willing buyer. Given the alternative of no competing bid at all, for example, the federal government would gain by leasing a coal tract for anything greater than the administrative cost of preparing the tract for a lease sale offering, conducting the sale, and the follow-up management costs. Let us say hypothetically that these costs are $100,000. If the tract is worth, say, $5 million to a single adjoining coal mine operator, and not much to anyone else, any lease price between $100,000 and $5 million could be said to be a "fair return"—an outcome reflecting a willing buyer and a willing seller transaction.

This possibility would later be borne out by the history of the federal coal program when more active leasing resumed in the 1990s. When the GAO examined federal coal lease sales from 1990 to 2012, it found that "more than 90 percent of the lease applications BLM received were for maintenance tracts used to extend the life of an existing mine or to expand that mine's annual production."[77] That went a long way to explain why only 10 out of the total 107 leases sold by the BLM from 1990 to 2012 received more than one bid. Only one federal lease offered for sale received more than two bids. Among a total of 31 federal coal leases sold in Wyoming from 1990 to 2012, only five received more than one bid (all five received two bids).

## CONCLUSION

In the name of capturing fair market value, the strongest pressures in recent years on the federal coal program have been to raise more government revenues. Many commentators argue that current levels of federal coal lease revenues are significantly below a fair public return on the immense amounts of federal coal in the Wyoming Powder River Basin. A common proposal has been that the federal government should increase its royalty rate above the current 12.5 percent for surface-mined coal. Few of these commentators show much if any concern that—given the dominant federal ownership role in the Wyoming Powder River Basin—maximizing government revenues could be accomplished most successfully through a monopolistic strategy of federal coal pricing.

Economists are taught from their first courses in economic theory that monopoly pricing is an undesirable distortion of the efficiency of a competitive market system. The U.S. Justice Department has an anti-trust division dedicated to the prevention of monopolistic pricing throughout the U.S. economy. Why, then, might the federal government want to charge monopoly prices (specifically royalties) in the management of federal coal?

It might be argued that the federal government should capture anti-competitive revenues because otherwise the coal companies in the Powder River Basin and elsewhere will capture the same anti-competitive gains for themselves. If there is any truth in this, however, it would be because the federal government has leased insufficient amounts of federal coal, thus failing to generate adequate levels of competition among coal companies to supply utility contracts. More aggressive federal leasing, including the offering of large stand-alone tracts capable of supporting a brand new mine, would be the answer. However, with major coal companies such as Peabody Energy going bankrupt today, it becomes less plausible that Powder River coal companies are exploiting the utilities and their customers to collect anti-competitive profits.

Historically, one justification for federal coal royalties has been that federal coal development imposes large external costs on the states and localities where the coal development

is occurring. It would be more accurate to say, however, that federal coal (and other mineral) development creates financial windfalls for many western states and localities which receive around half the royalty and other federal mineral revenues. In 2015 the state of Wyoming, for example, received about $1 billion in federal coal royalties and other mineral leasing revenues (including oil and gas). The states also often impose their own severance taxes on top of federal royalties. Indeed, the wages and other contributions to local economies of mineral development are well above the average for other sectors of the Wyoming economy.

A more recent argument seeks to justify much higher federal royalties on the basis of reflecting the social costs associated with the carbon emissions resulting from the burning of federal coal. This may, however, be a new rationale for more aggressive federal anti-competitive pricing. As many leading economists have argued, a nationwide tax on carbon emissions makes a great deal of sense. Focusing on one limited part of the total sources of U.S. carbon emissions such as Powder River federal coal, however, makes less sense. Indeed, it would likely create its own significant economic distortions. Even if that were not the case, estimates of the dollar value of the actual social cost of carbon from U.S. emissions cover an extremely wide range, depending on the specific assumptions made by those making the calculations. With this huge uncertainty, it would be difficult for the federal government to justify basing federal coal royalties on any particular social cost of carbon when the practical effect might be severely harmful to workers, coal companies, and other segments of the local Powder River Basin economy.

An effort to keep federal coal in the ground at this point would probably have greater symbolic than practical significance in terms of total future U.S. coal use and carbon emissions from coal burning—even as it would be politically controversial and would divert attention from more substantive demand-based methods of managing and limiting carbon emissions in the United States. It would also further exacerbate the existing political tensions in the West concerning the pervasive land and resource ownership role of the federal government there, which leaves westerners with less control over their own rural destinies than residents of other states.

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"Robert Nelson was 'Mr. Coal' during his years on the Economic Staff in the Office of the Secretary of the Interior where he had a major influence on the design of the federal coal leasing program and on the report of the Linowes Commission. His penetrating analysis of the current issues in federal coal leasing could set a new course for an old program."

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